MATHEMATICIANS ASSOCIATION

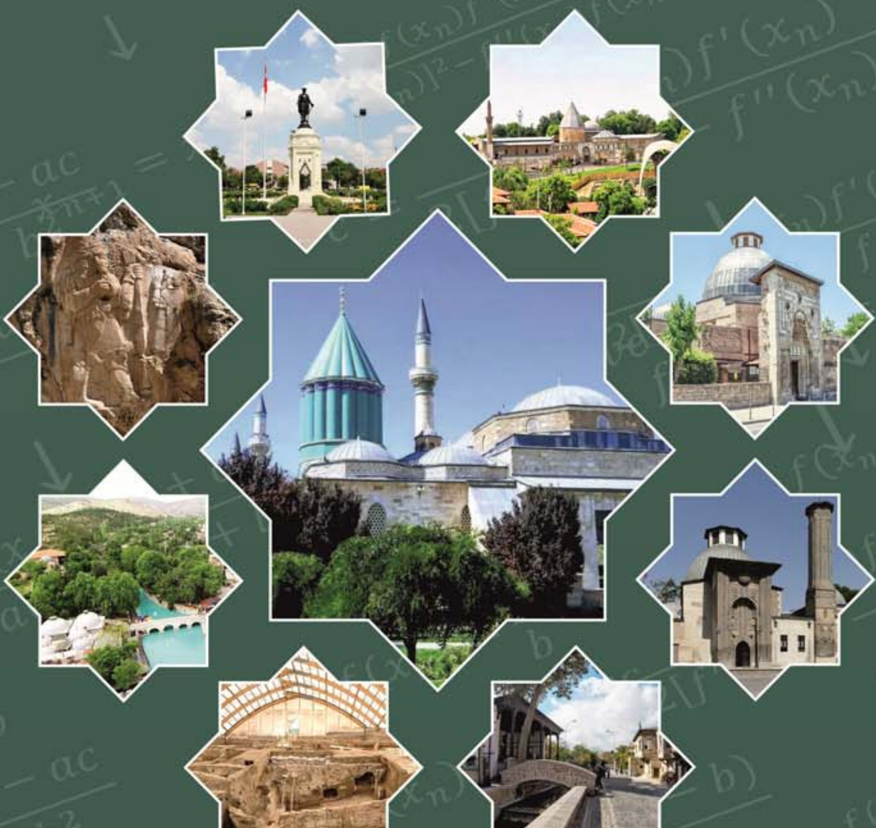
SELÇUK UNIVERSITY

ICMME 2019

INTERNATIONAL CONFERENCE ON MATHEMATICS AND MATHEMATICS EDUCATION

July 11-13, 2019 – Selçuk University

ABSTRACT BOOK



Mathematics in Konya, Land of Tolerance

International Conference on Mathematics and Mathematics Education (ICMME 2019)

Abstract Book

International Conference on Mathematics and Mathematics Education **(ICMME 2019)**

Selçuk University, Konya, Turkey, July 11-13, 2019

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PREFACE

The International Conference on Mathematics and Mathematics Education with the theme "Mathematics in Konya, Land of Tolerance" has been held on July 11-13, 2019 in Konya, Turkey.

MATDER (Mathematicians Association) is an association founded in 1995 by mathematicians in Turkey. Up to now 14 national and 3 international mathematics symposium were organized by MATDER.

The last three conferences have been held in Ordu (ICMME 2018), Şanlıurfa (ICMME 2017), Elazığ (ICMME 2016) as an international conference. These meetings have been one of the main international symposiums. Since the talks in the meetings cover almost all areas of mathematics, mathematics education, and engineering mathematics, the conferences have been well attended by mathematicians from academia, Ministry of Education and engineers as well.

The main aim of this conference is to contribute to the development of mathematical sciences, mathematical education, and their applications and to bring together the members of the mathematics community, interdisciplinary researchers, educators, mathematicians, and statisticians from all over the world. The conference will present new results and future challenges, in series of invited and short talks, poster presentations, workshops, and exhibitions. All presented paper's abstracts have been published in the conference abstract book.

Moreover, selected and peer review full articles will be published in the following journals:

- Turkish Journal of Mathematics and Computer Science (TJMCS)
- MATDER Matematik Eğitim Dergisi
- Konuralp Journal of Mathematics (KJM)

This conference is organised by MATDER-Association of Mathematicians and hosted by Selçuk University.

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CONTENTS

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SPEAKERS

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Mathemata, A Concept Between the Known and Unknown: Rereading the History of Mathematics in the Islamic Civilization within the Context of the Term 'Hisab'

İhsan FAZLIOĞLU

İstanbul Medeniyet University

ABSTRACT

The paper will focus on the transformation of the concept of ‘mathemata’ after the invention of the term 'Hisab' which is a calculation technique based on the ‘relations’ between numbers and the ‘relations’ between the magnitudes. Mathemata is inherited by the Islamic civilisation from the ancient civilisations and derives from two terms: arithmos (number) and megethos (magnitude). It is considered to be the study of ‘essence’. Additionally, the paper will examine how this new concept arithmetizates the known (sexagesimal, mental, and Indian) and unknown (algebra) quantities. Moreover, it will deal with how the science of surveying (misāḥa) is conducted by using the quantitative representation of the concept magnitude. It will introduce the Seljuk, Ottoman, and Andalusian scholars and treatises that had role in canonization of the taḥrīr movement on mathematical sciences which was began in Marw.

Classes of Systems of Differential Equations of High Dimension

Gennadii V. DEMIDENKO

Sobolev Institue of Mathematics

ABSTRACT

In this talk, we establish new connections between solutions to classes of systems of nonlinear ordinary differential equations of high dimension and solutions to delay differential equations. These connections make it possible to find approximate solutions to the systems of high dimension by reducing theirs to delay differential equations. Examples of such systems are systems arising when modeling some biological processes; moreover, the dimensions of these systems may be so large that their solving by a computer may constitute a very complicated problem. Such high-dimensional problems in mathematical biology originated authors studies in this direction.

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Some New Results Related to Lorentz Gτ-Spaces and Interpolation

Amiran GOTATISHVILI

Czech Acad. of Science

ABSTRACT

We give definition of a new generalized Weighted Lorentz GΓ-spaces. Some properties of these spaces will presented. We will show that these paces are interpolation space in the sense of Peetre between classical Lorentz spaces. These spaces are obtained also from weighted Cesàro and Copson spaces by so call “symmetrisation”. We give a characterization of the interpolation space in the sense of Peetre for some couple of spaces as small or classical Lebesgue space or Lorentz-Marcinkiewicz spaces. It happens that the result is always a GΓ- space, since this last space covers many spaces.

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Robustness Of Synchronization In A System With A Diffusive-Time-Lag Coupling

Adu A.M. WASIKE

School of Science and Information Sciences

ABSTRACT

Lattice differential equations have been studied with a view of establishing their long time behavior. Normal Hyperbolicity has been used to establish conditions for stability and persistence of the synchronization manifold. In most cases, Lattice structures can take different topological structures depending on the nature of coupling. The degree of structural stability and persistence depends on the coupling configuration; whether it is all-to-all, coupling on a circle, or simple Bravis structure. We use Hausdorff measure to demontrate the robustness of these topological structures.

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Mathematics Teacher Educators: Current Situation and Future Projections

Mehmet Fatih ÖZMANTAR

Gaziantep University

ABSTRACT

In this presentation, findings of a recent research study on the present situation of mathematics teacher educators who are actively involved in teacher preparation programs will be shared. The important issues that the findings indicate will be addressed with reference to above-cited questions. The future projection of mathematics teacher educators will be presented and the areas that require further research will be discussed with the participants.

Analyses For Inverse Problems Related to the Fukushima Daiichi Nuclear Disaster: An Application of Mathematics

Masahiro YAMAMOTO

University of Tokyo

ABSTRACT

The Fukushima Daiichi Nuclear Disaster in March 2011 has released cesium-137 etc. into environments. The long-standing prediction of the diffusion is important and for it, the starting point is inverse problems of determining unknown physical parameters on the basis of model equations. Moreover some extrapolation procedure of measured data is a kind of inverse problems. I discuss the following three related inverse problems and present numerical results for field data as well as theoretical results such as the uniqueness and the stability:

• Determination of amplitude of explosion

• Diffusion of radioactive substances in the soil related to the decontamination of farm- lands and estimation of air dose rate of radioactive substances

• air dose rate of radioactive substances at the human height level by high-altitude data by drones The incident was very serious but the needed mathematical analysis is quite standard. I intend to demonstrate that the talk is a case study where mathematics is effective also for such serious real-world problems.

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Linear Algebra without Determinant

Haydar BULGAK

Selçuk University

ABSTRACT

A brief description of the structure of a standard undergraduate course of linear algebra is given. This course uses only concepts which are relevant from the point of view of computing with finite accuracy. Thus, the spectral theory and the theory of linear equations do not use concept of determinant.

Importance Of Mathematical Modeling And Optimization in Industrial Applications

Mete KALYONCU

Konya Technical University

ABSTRACT

Generally speaking, the importance of mathematical modeling and optimization in real industry applications and its benefits will be discussed. In various applications carried out in industry, the way of implication, results achieved, the advantages provided of the mathematical modeling and optimization works will be explained.

Maximal and singular integral operators and their commutators in variable exponent generalized weighted Morrey spaces

Vagif S. GULIYEV

Kütahya Dumlupınar University

ABSTRACT

We consider the generalized weighted Morrey spaces $M_{p,\varphi}(\omega)$ with variable exponent *p*(*x*) and a general function φ (*x*, *r*) defining the Morrey- type norm. We prove the boundedness of the Hardy-Littlewood maximal operator and Calderon-Zygmund singular operators with standard kernel, in such spaces. We also prove the boundedness of the commutators of max- imal operator and Calderon-Zygmund singular operators in the variable exponent generalized weighted Morrey spaces.

Abstract Omega Algebra that Subsumes Tropical Min and Max Plus Algebras

Cenap ÖZEL

King Abdulaziz University

ABSTRACT

In this talk abstract omega algebra is introduced and the definition is modeled in such a way that it subsumes almost all so called tropical min and max plus algebras. Concrete examples of distinct nature of these algebras are presented. As applications, symmetrized omega algebras are constructed and matrices with basic operations and some topological distances over them are defined.

ALGEBRA

AND

NUMBER THEORY

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Binomial double sums including Lucas numbers

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ABSTRACT

The Lucas series or Lucas numbers are integer sequences named after the mathematician François Édouard Anatole Lucas (1842–91).

The Fibonacci numbers F_n and Lucas numbers L_n are defined for $n>1$ by the following recursions:

$$F_n = F_{n-1} + F_{n-2} \text{ and } L_n = L_{n-1} + L_{n-2}$$

with initial values $F_0 = 0$, $F_1 = 1$ and $L_0 = 2$, $L_1 = 1$, respectively.

In 1843, the Binet formulas were given by Binet for the usual Fibonacci and Lucas numbers F_n and L_n by using the roots of the characteristic equation $x^2 - x - 1 = 0$:

$$F_n = \frac{\alpha^n - \beta^n}{\alpha - \beta} \text{ and } L_n = \alpha^n + \beta^n$$

where α is called Golden Proportion.

There are many types of identities involving sums of products of binomial coefficients and Fibonacci or Lucas numbers. Many authors have computed various weighted binomial sums by various methods. Recently many binomial sums including double sums have started to consider. These are some special families of binomial double sums including one binomial coefficient and Fibonacci numbers as well as their alternating analogues.

In this study, we shall consider and compute some special double sums involving the Lucas numbers and one binomial coefficient of the form

$$\sum_{0 \le i, j \le n} \binom{i}{j} L_{ri+tj}$$

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for some integers r and t.

These sums have nice results. They can be expressed as products of Fibonacci and Lucas numbers. For example, we show that let t be integer. For nonnegative integer n,

$$\sum_{0\le i,j\le n}\binom{i}{j}L_{(4t+1)i-j}=\frac{1}{L_{2t+1}}\begin{cases}L_{(2t+1)n}L_{(2t+1)(n+1)} & \text{if } n \text{ is even},\\ 5F_{(2t+1)n}F_{(2t+1)(n+1)} & \text{if } n \text{ is odd}.\end{cases}$$

We use Binomial theorem, Binet formulas for Fibonacci and Lucas numbers, and some new Fibonacci-Lucas identities to prove claimed results.

Key Words: Fibonacci numbers, Lucas numbers, double binomial sums.

MSC: 11B39, 05A10.

REFERENCES

[1] A. F. Horadam, Basic properties of a certain generalized sequence of numbers, Fibonacci Quart., 3 (3) (1965), 161-176.

[2] E. Kılıç, İ. Akkuş, N. Ömür and Y. T. Ulutaş, Formulas for binomial sums including powers of Fibonacci and Lucas numbers, UPB Scientific Bulletin, Series A 77(4) (2015), 69-78.

[3] E. Kılıç and T. Arıkan, Double binomial sums and double sums related with certain linear recurrences of various order, Chiang Mai J. Sci., 45(3) (2018), 1569-1577.

[4] E. Kılıç and H. Belbachir, Generalized double binomial sums families by generating functions, Util. Math., 104 (2017), 161-174.

[5] E. Kılıç, N. Ömür and Y. T. Ulutaş, Binomial sums whose coefficients are products of terms of binary sequences, Util. Math., 84 (2011), 45-52.

[6] E. Kılıç and F. Taşdemir, On binomial double sums with Fibonacci and Lucas numbers-I, Ars Combin., 144 (2019), 173-185.

[7] E. Kılıç and F. Taşdemir, On binomial double sums with Fibonacci and Lucas numbers-II, Ars Combin., 144 (2019), 345-354.

[8] F. Taşdemir and T. Göresim Toska, Formulas for binomial double sums related to Lucas numbers, accepted in Ars Combin.

Generalized Fibonacci and Lucas p- quaternions

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ABSTRACT

In [4], the authors gave the definition of the generalized quaternion as follows

$$q = a_0 + a_1 i + a_2 j + a_3 k$$

where a_0, a_1, a_2 and a_3 are real numbers and i, j, k are quaternionic units which satisfy the equalities

$$i^2 = -\alpha, \quad j^2 = -\beta, \quad k^2 = -\alpha\beta$$
$$ij = k = -ji, \quad jk = \beta i = -kj$$

and

$$ki = \alpha j = -ik, \quad \alpha, \beta \in \mathbb{R} .$$

For the special values of α and β, we have quaternions and split quaternions. In [3], the author investigated Fibonacci quaternions. Akyigit defined the split Fibonacci quaternions and gave the properties in [1]. Also, many authors obtained the properties of generalized Fibonacci and Pell quaternions [2, 6]. In [5,7], the authors defined the generalized Fibonacci and Lucas p- numbers and bivariate Fibonacci and Lucas p- polynomials.

In this paper, considering the generalized quaternions and generalized Fibonacci and Lucas $p-$numbers, we define generalized Fibonacci and Lucas $p-$quaternions as following

$$QF_{p,m}(n) = F_{p,m}(n) + iF_{p,m}(n+1) + jF_{p,m}(n+2) + kF_{p,m}(n+3)$$

and

$$QL_{p,m}(n) = L_{p,m}(n) + iL_{p,m}(n+1) + jL_{p,m}(n+2) + kL_{p,m}(n+3)$$

Afterwards, we obtain the properties and some identities connected with generalized Fibonacci and Lucas $p-$quaternions. Also, we give the results for the special cases of the generalized Fibonacci and Lucas $p-$quaternions.

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Key Words: Fibonacci and Lucas $p-$numbers, generalized quaternions.

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REFERENCES

[1] Akyigit, M., Kosal, H.H., Tosun M., Split Fibonacci Quaternions, Adv. Appl. Clifford Algebras 23 (2013), 535-545.

[2] Akyiğit M., Kösal H. H., Tosun M., Fibonacci Generalized Quaternions, Adv. Appl. Clifford Algebras 24 (2014), 631-641.

[3] Iyer, M.R., A Note On Fibonacci Quaternion, Fibonacci Quart. 3(1969), 225-229.

[4] Jafari M., Yaylı Y., Generalized Quaternions and Their Algebraic Properties, Commun. Fac. Sci. Univ. Ank. Series A1 Volume 64, Number 1, Pages 15-27 (2015).

[5] Kocer E.G., Tuglu N., Stakhov A., On the m-extension of the Fibonacci and Lucas p-numbers, Chaos, Solitons and Fractals 40 (2009) 1890-1906.

[6] Tokeser U., Unal Z., Bilgici G., Split Pell and Pell-Lucas Quaternions, Adv. Appl. Clifford Algebras 27 (2017), 1881-1893.

[7] Tuglu N., Kocer E.G., Stakhov A., Bivariate Fibonacci like p-polynomials, Applied Mathematics and Computation 217 (2011) 10239-10246.

Improved bounds for the number of spanning trees of graphs

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ABSTRACT

Let G be a simple connected graph with n vertices and m edges. $R_\alpha = R_\alpha(G) = \sum_{v_i \sim v_j} \left(d_i d_j\right)^\alpha$ is the general Randić index (Bollobas and Erdös 1998) of the graph G, where d_i is the degree of the vertex v_i and $\alpha \neq 0$ is a fixed real number. Note that the Randić index $R_{-1} = R_{-1}(G) = \sum_{v_i \sim v_j} \frac{1}{d_i d_j}$ is also well studied in the literature. The (normalized) Laplacian eigenvalues of the graph G are the eigenvalues of the the (normalized) Laplacian matrix of G. Among various indices in mathematical chemistry, the Kirchhoff index $K_f(G)$ and a relative of it, the degree Kirchhoff index $K'_f(G)$, have received a great deal of attention, recently. For a connected undirected graph G, the Kirchhoff index was defined in (Klein and Randic 1993) as $K_f = K_f(G) = \sum_{i<j} r_{ij}$, where r_{ij} is the effective resistance of the edge $v_i v_j$. The degree Kirchhoff index was proposed in (Chen and Zhang 2007), is defined as $K'_f = K'_f(G) = \sum_{i<j} d_i d_j r_{ij}$. The degree Kirchhoff index has been taken attention as much as the Kirchhoff index. We just want to remind the expression of Kirchhoff index in terms of the Laplacian eigenvalues (Gutman and Mohar 1996) as in the equality $K_f = K_f(G) = n\sum_{i=1}^{n-1} \frac{1}{\mu_i}.$

Moreover, in (Chen and Zhang 2007), by considering normalized Laplacian eigenvalues, the degree Kirchhoff index is defined as $K'_f = K'_f(G) = 2m\sum_{i=1}^{n-1} \frac{1}{\lambda_i}.$

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The number of spanning trees, $t(G)$, of a graph G is equal to the total number of distinct spanning subgraphs of G that are trees. This quantity is also known as the complexity of G, and is given by the following formula in terms of the Laplacian eigenvalues (Cvetkovic 1980), $t(G) = \frac{1}{n}\prod_{i=1}^{n-1}\mu_i$.

It is well known that the number of spanning trees of G is can be expressed by the normalized Laplacian eigenvalues as (Chung 1997, Cvetkovic 1980)

$$t(G) = \left(\frac{\Delta'}{2m}\right)\prod_{i=1}^{n-1}\lambda_i \text{ , where } \Delta' = \prod_{i=1}^{n} d_i \text{ .}$$

In this study, we obtain some bounds on the number of spanning trees of connected graphs in terms of the number of vertices, the number of edges, degree Kirchhoff index and Randić index (R_{-1}). We also improve some bounds which was obtained previously for the number of spanning trees of graphs.

Key Words: Spanning trees, normalized Laplacian eigenvalues, (degree) Kirchhoff index, Randic index (R_{-1}).

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REFERENCES

[1] B. Bollobas, P. Erdös, "Graphs of extremal weights", Ars Combinatoria, vol. 50, pp. 225-233, 1998.

[2] H. Chen, F. Zhang, "Resistance distance and the normalized Laplacian Spectrum", Discrete App. Math., vol. 155, pp. 654-661, 2007.

[3] F.R.K. Chung, Spectral Graph Theory, CBMS Lecture Notes, Providence, 1997.

[4] D. Cvetković, M. Doob, H. Sachs, Spectra of Graphs, Academic Press, New York, 1980.

[5] I. Gutman, B. Mohar, "The quasi-Wiener and the Kirchhoff indices Coincide", J. Chem. Inf. Comput. Sci., vol. 36, pp. 982-985, 1996.

[6] D.J. Klein, M. Randić, "Resistance distance. Applied graph theory and discrete mathematics in chemistry (Saskatoon, SK, 1991)", J. Math. Chem., vol. 12, no. 1-4, pp. 81-95, 1993.

Some identities of *b*-generalized derivations on prime rings

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ABSTRACT

Let R be a prime ring with center $Z(R)$, right Martindale quotient ring Q and extended centroid C. By a b-generalized derivation we mean an additive mapping $g:R\to Q$ such that $g(xy)=g(x)y+bxd(y)$ for all $x,y\in R$, where $b\in Q$ and $d:R\to Q$ is an additive map. In this study we will investigate some identities concerning about b-generalized derivations.

Let $a,c\in R$ and $h,g:R\to Q$ are b-generalized derivations of R with the associated maps d and δ, respectively. We study the b-generalized derivations h and g satisfying any one of the following conditions: *(i)* $g(x)\in Z(R)$ for all $x\in R$; *(ii)* $cg(x)=0$ for all $x\in R$; *(iii)* $cg(x)\in Z(R)$ for all $x\in R$; *(iv)* $g(x)c=0$ for all $x\in R$; *(v)* $g(x)c\in Z(R)$ for all $x\in R$; *(vi)* $ag(x)c=0$ for all $x\in R$; *(vii)* $ch(x)=g(x)c$ for all $x\in R$.

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Key Words: Prime ring, *b*-generalized derivations.

Mathematics Subject Classification: 16W25, 16N60.

REFERENCES

[1] K. I. Beidar and W. S. Martindale, Rings with generalized identities, Pure and Applied Mathematics. Dekker, New York, 1996.

[2] M. Bresar, Functional identities of degree two, J. Algebra, 172 (1995) 690-720.

[3] M. T. Kosan and T. K. Lee, *b*-generalized derivations of semiprime rings having nilpotent values, J. Aust. Math. Soc. 96 (2014) 326-337.

On right (σ,τ)-Jordan ideals

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ABSTRACT

Let R be a ring and σ,τ two mappings of R and U an additive subgroup of R. For each r,s∈R we set $[r,s]_{\sigma,\tau}=r\sigma(s)-\tau(s)r$ and $(r,s)_{\sigma,\tau}=r\sigma(s)+\tau(s)r$. U is called a right (σ,τ)-Jordan ideal of R if $(U,R)_{\sigma,\tau}\subset U$. U is called a left (σ,τ)-Jordan ideal if $(R,U)_{\sigma,\tau}\subset U$. U is called a (σ,τ)-Jordan ideal if U is both right and left (σ,τ)-Jordan ideal of R. Every Jordan ideal of R is a (1,1)-Jordan ideal of R, where $1:R\to R$ is the identity map. A derivation d is an additive mapping on R which satisfies $d(rs)=d(r)s+rd(s)$, ∀r,s∈R. An additive mapping $h:R\to R$ is said to be a right generalized (σ,τ)-derivation of R associated with d if $h(xy)=h(x)\sigma(y)+\tau(x)d(y)$, for all x,y∈R and h is said to be a left generalized (σ,τ)-derivation of R associated with d if $h(xy)=d(x)\sigma(y)+\tau(x)h(y)$, for all x,y∈R. Every (σ,τ)-derivation $d:R\to R$ is a generalized (σ,τ)-derivation associated with d. In this work we generalized some results which are given in [5], [6], [8] and we present some new commutative conditions using the right (σ,τ)-Jordan ideals. The main object in this article is to study the situations. (1) $bh\gamma(U)=0$, (2) $h\gamma(U)b=0$, (3) $h\gamma(U)=0$, (4) $U\subset C_{\lambda,\mu}(V)$, (5) $bh(I)\subset C_{\lambda,\mu}(U)$ or $h(I)b\subset C_{\lambda,\mu}(U)$, (6) $bV\subset C\ C_{\lambda,\mu}(U)$ or $Vb\subset C_{\lambda,\mu}(U)$.

Key Words: Prime Ring, Generalized Derivation, (σ,τ)-Jordan Ideal.

MSC: 16W25, 16U80.

REFERENCES

[1] Bresar M., On the Distance of the Composition of Two Derivation to Generalized Derivations , Glasgow Math.J, 33 (1991).

[2] Chang J. C., On the Identity h(x)=af(x)+g(x)b, Taiwanese J. Math., 7, no.1 (2003).

[3] Güven E., One Sided (σ,τ)-Lie Ideals and Generalized Derivations in Prime Rings, Palestine Journal of Mathematics, (2018).

[4] Güven E., One Sided Generalized (σ,τ)-Derivations in Rings, Boletim Sociedade Paranaense de Matemática, (to appear).

[5] Kandamar H. and Kaya K, (σ,τ)-Right Jordan Ideals, C.Ü. Fen Bil. Derg. (1993).

[6] Kaya K., Kandamar H. and Aydın N., Generalized Jordan Structure of Prime Rings, Tr. J. of Math. (1993).

[7] Zaidi S. M. A. Ashraf, M. and Ali S. On Jordan Ideals and Left (θ,θ)-Derivations, in Prime Rings, Internat. J. of Math. and Math. Sci., 37 (2004).

[8] Mayne J. H., Centralizing Mappings of Prime Rings, Canad. Math. Bull., 27, (1984).

Circulant fuzzy neutrosophic soft matrices

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ABSTRACT

Neutrosophic logic is a mathematical model for handling problems involving vagueness, indeterminacy and inconsistent data is given in (Samarandache, 1999). Soft set theory is a mathematical tool for dealing with doubts in a parametric manner (Molodtsov, 1999). Neutrosophic sets have compounded with soft sets as neutrosophic soft sets as in the relevant article (Maji, 2013). The matrix is called fuzzy neutrosophic soft matrix if the elements are neutrosophic number (Arockiarani and Sumathi, 2014).

In this study, we introduced the concept of circulant fuzzy neutrosophic soft matrices (CFNSM). *A* fuzzy neutrosophic soft matrix $A=[\langle a_{ij}^T, a_{ij}^I, a_{ij}^F \rangle]$ is said to be circulant fuzzy neutrosophic soft matrix if all the elements of *A* can be determined completely by its first row. Suppose the first row of *A* is

$$A=[\langle a_1^T, a_1^I, a_1^F \rangle, \langle a_2^T, a_2^I, a_2^F \rangle, \ldots, \langle a_n^T, a_n^I, a_n^F \rangle].$$

Then any element a_{ij} of *A* can be determined (throughout element of the first row) as $a_{ij}=a_{1(n-i+j+1)}$ with $a_{1(n+k)}=a_{1k}$.

A circulant FNSM is the form of

$$\begin{bmatrix} \langle a_1^T, a_1^I, a_1^F \rangle & \langle a_2^T, a_2^I, a_2^F \rangle & \cdots & \langle a_{(n-1)}^T, a_{(n-1)}^I, a_{(n-1)}^F \rangle & \langle a_n^T, a_n^I, a_n^F \rangle \\ \langle a_n^T, a_n^I, a_n^F \rangle & \langle a_1^T, a_1^I, a_1^F \rangle & \cdots & \langle a_{(n-2)}^T, a_{(n-2)}^I, a_{(n-2)}^F \rangle & \langle a_{(n-1)}^T, a_{(n-1)}^I, a_{(n-1)}^F \rangle \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ \langle a_3^T, a_3^I, a_3^F \rangle & \langle a_4^T, a_4^I, a_4^F \rangle & \cdots & \langle a_1^T, a_1^I, a_1^F \rangle & \langle a_2^T, a_2^I, a_2^F \rangle \\ \langle a_2^T, a_2^I, a_2^F \rangle & \langle a_3^T, a_3^I, a_3^F \rangle & \cdots & \langle a_n^T, a_n^I, a_n^F \rangle & \langle a_1^T, a_1^I, a_1^F \rangle \end{bmatrix}$$

We present some operations on circulant fuzzy neutrosophic soft matrices (CFNSM). We also define the idea of reflexive, symmetric, transitive, determinant and

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adjoint of circulant fuzzy neutrosophic soft matrices (CFNSM). Finally, we develop an algorithm which is a new approach in medical diagnosis by implementing circulant fuzzy neutrosophic soft matrices.

Key Words: Circulant matrix, fuzzy neutrosophic soft matrix, circulant fuzzy neutrosophic soft matrix.

MSC: 03E72, 15B15.

REFERENCES

[1] F.Smarandache, A Unifying Field in Logics. Neutrosophy: Neutrosophic Probability,

[2] Set and Logic, American Research Press, Rehoboth,1999.

[3] Molodtsov, Soft set theory-first results, Comput. Math. Appl., 37, 19-31,1999.

[4] Pabitra Kumar Maji, Neutrosophic soft set, Annals of Fuzzy Mathematics and

[5] Informatics, 5(1) 157-168, 2013.

[6] I.R. Sumathi, I. Arockiarani, New Operations on Fuzzy Neutrosophic Soft Matrices, International Journal of Innovative Research and Studies, 3(2), 110-124, 2014.

Some properties on Cartesian product of the zero divisor graphs of commutative rings

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ABSTRACT

A zero-divisor graph is an undirected graph representing the zero divisors of a commutative ring. It has elements of the ring as its vertices, and pairs of elements whose product is zero as its edges (Anderson et.al 2011). In the original definition of Beck (Beck 1988), the vertices represent all elements of the ring. In a later variant studied by Anderson and Livingston (Anderson 1999), the vertices represent only the zero divisors of the given ring. Zero divisor graphs were largely studied in the last two decades (Anderson and Badawi 2017). The aim of this study is to continue to investigate the interaction between rings and graphical theoretical properties by studying zero-divisor graphs.

The Cartesian product of simple graphs *G* and *H* is the graph $G \times H$ whose vertex set is $V(G) \times V(H)$ and whose edge set is the set of all pairs $(u_1, v_1)(u_2, v_2)$ such that either $u_1u_2 \in E(G)$ and $v_1 = v_2$ or $v_1v_2 \in E(H)$ and $u_1 = u_2$ (Gross and Yellen 2004). It has been widely investigated, has numerous interesting algebraic properties.

In this paper, we thought the zero divisor graphs on the ring Z_n of integers modulo *n.* Furthermore, we have investigated some important graph parameters (diameter, radius, girth, maximum degree, minimum degree, degree sequences, irregularity index, domination number, chromatic number, clique number) for the Cartesian product of $\Gamma(Z_p)$ and $\Gamma(Z_q)$ graphs. Where *p* and *q* are primes. The obtained results are supported by numerical examples.

Key Words: The zero divisor graph, Cartesian product, graph parameters.

MSC : 05C12, 05C15, 05C25, 05C69, 06E20.

REFERENCES

[1] D. F. Anderson and A. Badawi, The zero-divisor graph of a commutative semigroup: a survey. In Groups, modules, and model theory – surveys and recent developments, pages 23-29. Springer, Cham. 2017.

[2] Beck, Coloring of commutative ring, Journal of Algebra, 116 (1988) 208-226.

[3] D.F. Anderson and P.S. Livingston, The zero-divisor graph of commutative ring, Journal of Algebra, 217 (1999) 434-447.

[4] D. F. Anderson, M. C. Axtell and J.A. Stickles, Zero-divisor graphs in commutative rings, Commutative Algebra, Noetherian and Non-Noetherian Perspectives (M. Fontana et al., Eds.), Springer-Verlag, New York, (2011), 23-45.

[5] D. F. Anderson and A. Badawi, On the zero-divisor graph of a ring, Comm. Algebra, 36(8) (2008) 3073-3092.

[6] D.D. Anderson and M. Naseer, Becks coloring of commutative ring, Journal of Algebra, 159 (1991) 500-514.

[7] JL. Gross and J. Yellen, Handbook of Graph Theory Chapman, Hall/CRC London (2004).

Decision of fuzzy neutrosophic soft matrix in geometric mean and harmonic mean

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ABSTRACT

The theory of neutrosophic set which is more general than their classical counterpart in fuzzy set, intuitionistic fuzzy set, paraconsistent set, tautological set and so on is introduced in (Samarandache, 1999). Neutrosophic set tackles the problems as T-truth value, I-indetermine value and F-falsity value which are independent.

In real life application it is difficult to use neutrosophic set. Therefore the single valued neutrosophic set is defined in (Wang et all, 2010). According to this definition, *E* is a universe. A single valued neutrosophic set (SVN-set) over *E* is a neutrosophic set over *E*, but the truth-membership function, indeterminacy-membership function and falsity-membership function are respectively defined by

$$T_A : E \to [0,1], I_A : E \to [0,1],\ F_A : E \to [0,1]$$

such that $0 \le T_A + F_A + I_A \le 3$ (Wang et all, 2010).

Single valued neutrosophic numbers are a special case of single valued neutrosophic sets and are of importance for neutrosophic multiattribute decision making problems. A single valued neutrosophic number seems to suitably describe an ill-known quantity (Deli and Subaş, 2014).

The matrix is called fuzzy neutrosophic soft matrix if the elements are neutrosophic number (Arockiarani and Sumathi, 2014). Fuzzy neutrosophic soft matrix is useful in dealing with areas such as decision making, relational equations, clustring analysis etc.

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In this study, we explore some properties of arithmetic mean, geometric mean and harmonic mean of fuzzy neutrosophic soft matrices and have introduced some operators on fuzzy neutrosophic soft matrix on the basis of weights. In the end, we have given an example on the geometric mean and harmonic mean for decision making problems. It indicates that the method can be successfully employed to many problems that contain uncertainties.

Key Words: Fuzzy neutrosophic soft matrix, geometric mean, harmonic mean.

MSC: 03E72, 15B15.

REFERENCES

[1] F.Smarandache, A Unifying Field in Logics. Neutrosophy: Neutrosophic Probability, Set and Logic, American Research Press, Rehoboth, 1999.

[2] Wang H, Smarandache FY, Zhang Q, Single valued neutrosophic sets. Multispace Multistructure 4, 410–413, 2010.

[3] Deli, I.; ¸Suba¸s, Y. A ranking method of single valued neutrosophic numbers and its applications to multi-attribute decision making problems. Int. J. Mach. Learn. Cybern. 8, 1309–1322, 2016.

[4] I.R. Sumathi, I. Arockiarani, New Operations on Fuzzy Neutrosophic Soft Matrices, International Journal of Innovative Research and Studies, 3(2), 110-124, 2014.

Total domination number of regular dendrimer graph

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ABSTRACT

Let $G=(V,E)$ be a simple connected graph whose vertex set V and the edge set E. For the open neighborhood of a vertex v in a graph G, the notation $N_G(v)$ is used as $N_G(v)=\{u|\ (u,v)\in E(G)\}$ and the closed neighborhood of v is used as $N_G[v]=N_G(v)\cup\{v\}$. For a set $S\subseteq V$, the open neighbourhood of S is $N(S)=\cup_{v\in S}N(v)$ and the closed neighborhood of S is $N[S]=N(S)\cup S$.

A subset $D\subseteq V$ is a dominating set, if every vertex in G either is element of D or is adjacent to at least one vertex in D. The domination number of a graph G is denoted with $\gamma(G)$ and it is equal to the minimum cardinality of a dominating set in G. By a similar definition, a subset $D\subseteq V$ is a total domination set if every vertex of D has a neighbor in D. The total domination number of a graph G is denoted with $\gamma_t(G)$ and it is equal to the minimum cardinality of a total dominating set in G. Fundamental notions of domination theory are outlined in the books [1] and [2].

A regular dendrimer $T_{k,d}$ is a tree with a central vertex v. Every non-pendant vertex of $T_{k,d}$ is of degree $d\geq 2$ ank the radius is k, distance from v to each pendant vertex. In this paper we obtain total domination number of a regular dendrimer graph such as in the following station,

$$\gamma_t(T_{k,d})=\begin{cases}2+d^2(d-1)\dfrac{(d-1)^k-1}{(d-1)^4-1} & ,k\equiv 0\ (mod4)\\ 2+d^2(d-1)^2\dfrac{(d-1)^{k-1}-1}{(d-1)^4-1} & ,k\equiv 1\ (mod4)\\ 1+d+d^2(d-1)^3\dfrac{(d-1)^{k-2}-1}{(d-1)^4-1} & ,k\equiv 2\ (mod4)\\ d^2\dfrac{(d-1)^{k+1}-1}{(d-1)^4-1} & ,k\equiv 3\ (mod4)\end{cases}$$

Key Words: Domination, Total Domination, Dendrimer Graph

MSC: 05C69

REFERENCES

[1] T.W. Haynes, S.T. Hedetniemi, P.J. Slater, Fundamentals of Domination in Graphs, Marcel Dekker, New York, 1998.

[2] T.W. Haynes, S.T. Hedetniemi, P.J. Slater (eds), Domination in Graphs: Advanced Topics, Marcel Dekker, New York, 1998.

Some properties of Fibo-Bernoulli matrices

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ABSTRACT

In this study, we obtain a new exponential generating function for the Bernoulli's F-polynomials and their several properties. Then, we define the Fibo-Bernoulli matrix by using the Bernoulli's F-polynomials. We obtain factorization the Fibo-Bernoulli matrix by using the generalized Fibo-Pascal matrix and a special matrix whose entries are the Bernoulli-Fibonacci numbers in $[\mathbf{2},\mathbf{5}]$. We find inverse of the Fibo-Bernoulli matrix.

The Fibonacci sequence $\{F_n\}_{n\geq 0}$ is defined by $F_0 = 0,\ F_1 = 1$ initial conditions and recurrence relation for $n \geq 2$

$$F_n = F_{n+2} = F_{n+1} + F_n.$$

The F-factorial is defined as follows:

$$F_n! = F_n F_{n-1} F_{n-2} \dots F_1, \quad F_0! = 1.$$

The Fibonomial coefficients are defined $n \geq k \geq 1\ as$

$$\binom{n}{k}_F = \frac{F_n!}{F_{n-k}!\,F_k!}$$

with $\binom{n}{0}_F = 1$ and $\binom{n}{k}_F = 0$ for $n < k$.

Let $\binom{n}{k}_F$ be Fibonomial coefficients and F_n be *n*th Fibonacci numbers, the Bernoulli's F-polynomials are defined by

$$B_{n,F}(x) = \sum_{k\geq 0} \frac{1}{F_{k+1}} \binom{n}{k}_F x^{n-k}$$

in $[\mathbf{3}]$.

In $[\mathbf{5}]$, the author defined the nth Bernoulli-Fibonacci numbers and the Bernoulli-Fibonacci polynomials. For all nonnegative integers n, the nth Bernoulli-Fibonacci polynomials $B_n^F(x)$ are given with exponential generating function.

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We give the relationship of first few Bernoulli's F-polynomials $B_{n,F}(x)$ Bernoulli-Fibonacci polynomials $B_n^F(x)$ and classical Bernoulli polynomials $B_n(x)$ with graphics. Furthermore we obtain exponential generating function of the Bernoulli's F-polynomial as follows

$$g(x) = \frac{e_F^{xt}(e_F^t - 1)}{t}.$$

Let $B_{n,F}(x)$ be *n*th Bernoulli's F-polynomial, the Fibo-Bernoulli matrix $\mathfrak{B}(x,F) = \left[b_{ij}(x,F)\right]_{(n+1)\times(n+1)}$ is defined by

$$b_{ij}(x,F) = \begin{cases} \binom{i}{j}_F B_{i-j,F}(x), & i \geq j \\ 0, & i < j \end{cases}$$

Then we show that

$$\mathfrak{B}(x,F) = U_{n+1}[x]\, W(F)$$

where $W(F)$ is is inverse of Fibo-Euler polynomial matrix. Using this factorization, we obtain inverse of the Fibo-Bernoulli matrices.

Key Words: Bernoulli F-polynomials, Bernoulli polynomials, Fibo-Bernoulli matrices.

MSC: 11B68, 15A23

REFERENCES

[1] D.S. Kim, T. Kim, q-Bernoulli polynomials and q-umbral calculus. Sci. China Math. (2014) 57, 1867-1874.

[2] E. G. Kocer, N. Tuglu, The Pascal matrix associated with Fontené-Ward generalized binomial coefficients, 4th International Conference on Matrix Analysis and Applications (ICMAA) 2-5 July, Konya, Turkey, 2013.

[3] E. Krot, An introduction to finite fibonomial calculus, ArXiv:math/0503210, 2005.

[4] S. Kuş, N. Tuglu, T. Kim, Bernoulli F-polynomials and Fibo-Bernoulli matrices, Advances in Difference Equations, (2019) 2019, 145.

[5] M. Özvatan, Generalized golden-Fibonacci calculus and applications, Graduate School of Engineering and Sciences of Izmir Institute of Technology, Master Thesis, July, 2018.

[6] N. Tuglu, S. Kuş, q-Bernoulli matrices and their some properties, Gazi Univ. J. of Science 28 (2015) 269-273.

[7] Z. Zhang, J, Whang, Bernoulli matrix and its algebraic properties, Discrete Appl. Math. 154 (2006) 1622-1632.

Padovan and Pell-Padovan octonions

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ABSTRACT

Octonion algebra is eight dimensional, non-commutative, non-associative and normed division algebra. Various families of octonion number sequences such as Fibonacci octonion, Lucas octonion, Pell octonion and Jacobsthal octonion have been established by a number of authors in many different ways. In addition, formulas and identities involving these octonions have been presented.

In this paper, we aim at establishing new classes of octonion numbers associated with the Padovan and Pell-Padovan numbers. We introduce Padovan octonions by using recurrence relation $P_n = P_{n-2} + P_{n-3}$ of the Padovan sequence is defined by the initial values $P_0 = 1$, $P_1 = 1$, $P_2 = 1$ for all $n \geq 3$ and Pell-Padovan octonions by using recurrence relation $R_n = 2R_{n-2} + R_{n-3}$of the Padovan sequence is defined by the initial values $R_0 = 1$, $R_1 = 1$, $R_2 = 1$ for all $n \geq 3$. It is introduced the Binet formulas known as the general formula and given n-th general term of these octonions are found by using recurrence relation of the new defined Padovan and Pell-Padovan octonions. Also, we give the generating functions, sum formulas and some properties for these octonions. Moreover we present the matrix representation of Padovan and Pell-Padovan octonions and the terms of these octonions are derivated by the matrix.

Key Words: Padovan numbers, Pell-Padovan numbers, Padovan octonions, Pell-Padovan octonions.

REFERENCES

[1] J. Baez, The octonions, Bull. Amer. Math. Soc. 39 (2), (2002), 145-205.

[2] S. Kritsana, Matrices formula for Padovan and Perrin Sequences, Applied Mathematics Science, 7 (142), (2013), 7093-7096.

[3] O. Keçioğlu and I. Akkuş, The Fibonacci Octonions, Adv. Appl. Clifford Algebr. 25, (2015), 151-158.

ISBN: 978-605-184-176-2

[4] I. Akkus and O. Keçilioglu, Split Fibonacci and Lucas octonions. Adv. Appl. Clifford Algebras 25(3), (2015), 517–525.

[5] C.B. Cimen and A. İpek, On Pell quaternions and Pell–Lucas quaternions. Adv. Appl. Clifford Algebras 26(1), (2016), 39–51.

[6] C.B. Cimen and A. İpek, On Jacobsthal and Jacobsthal–Lucas Octonions. Mediterr. J. Math., 14(37), (2017), 13pp.

Perrin octonions and Perrin sedenions

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ABSTRACT

Octonion algebra is 8-dimensional, non-commutative, non-associative and normed division algebra over the real numbers. Sedenions are obtained by applying the Cayley–Dickson construction to the octonions and form a 16-dimensional non-associative and non-commutative algebra over the set of real numbers.

Many different classes of octonion and sedenion number sequences such as Fibonacci octonion and sedenion, Lucas octonion and sedenion, Pell octonion and sedenion have been obtained by a number of authors in many different ways. In addition, generating functions, Binet formulas and some identities for these octonions and sedenions have been presented.

In this paper, we introduce new classes of octonion and sedenion numbers associated with Perrin numbers. We define Perrin octonions and Perrin sedenions by using recurrence relation $P_n = P_{n-2} + P_{n-3}$ of the Perrin sequence is defined by the initial values $P_0 = 3$, $P_1 = 0$, $P_2 = 2$ for all $n \geq 3$. We give the Binet formulas given n-th general term of these octonions and sedenions are found by using recurrence relation of the new defined Perrin octonions and Perrin sedenions. Also, we obtain the generating functions, sum formulas and some basic identities for these octonions and sedenions. Moreover we give the matrix representation of Perrin octonions and Perrin sedenions.

Key Words: Perrin numbers, Perrin octonions, Perrin sedenions.

REFERENCES

[1] K. Imaeda, M. Imaeda, Sedenions: algebra and analysis, Applied Mathematics and Computation, 115, (2000), 77-88.

[2] J. Baez, The octonions, Bull. Amer. Math. Soc. 39 (2), (2002), 145-205.

[3] A. G. Shannon, P. G. Anderson, and A. F. Horadam, Properties of Cordonnier, Perrin and van der laan numbers, International Journal of Mathematical Education in Science and Technology, 37(7), (2006), 825-831.

[4] I. Akkus and O. Keçilioglu, Split Fibonacci and Lucas octonions. Adv. Appl. Clifford Algebras 25(3), (2015), 517–525.

[5] Catarino, P. k-Pell, k-Pell-Lucas and Modified k-Pell sedenions. Asian-Eur. J. Math. (2018), S1793557119500189.

[6] G. Bilgici, Ü. Tokeşer and Z. Ünal, Fibonacci and Lucas Sedenions. J. Integer Seq., 20, 17.1.8, (2017), 11p

Fuzzy rough subgroups on approximation space

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ABSTRACT

To deal with vagueness, Rough sets and fuzzy sets are two efficient set theories. Fuzzy sets are firstly introduced by Lotfi Zadeh (Zadeh 1965). Fuzzy subgroups were defined and established by Rosenfeld (Rosenfeld 1971). In (Pawlak 1982), theory of rough sets is given. In (Kuroki and Wang 1996), Kuroki and Wang introduced the upper and lower approximations together with normal subgroups in a group. On the other hand, definitions of the notation of rough subgroups and rough groups are given by using only the upper approximation (Biswas and Nanda 1994). Miao et al. developed the rough group and rough subgroup definitions and proved some new characteristics (Miao et al. 2005).

In the theory of rough sets, an ordered pair (*U;R*) is called an approximation space, where *U* is a finite non- empty set called universe and *R* is an equivalent relation on *U*. Current study is devoted to give an introduction to the fuzzy rough subgroup in a rough group and the concept of a fuzzy rough subset within the scope of an approximation space. Then some basic properties and examples of these two concepts are given.

Key Words: Rough Subgroup, Rough Group, Fuzzy Subgroups, Fuzzy Rough Subgroup, Approximation Space.

MSC : 03, 20.

REFERENCES

[1] L.A. Zadeh, Fuzzy sets, Inform. and Control,vol. 8, pp. 338-353, 1965.

[2] A. Rosenfeld, Fuzzy groups, J. Math. Anal. Appl., vol. 35, pp. 512-517, 1971.

[3] Z. Pawlak, Rough sets, Int. J. Comput. Inform. Sci., vol. 11, pp. 341-356, 1982.

[4] N. Kuroki and P.P. Wang, The lower and upper approximations in a fuzzy group, Information Sciences, vol. 90, pp. 203-220, 1996.

[5] R. Biswas and S. Nanda, Rough groups and rough subgroups, Bull. Polish Acad. Sci. Math., vol.42, pp. 251-254, 1994.

[6] D. Miao, S. Han, D. Li and L. Sun, Rough Group, Rough Subgroup and Their Properties, D. ´Slkezak et al. (Eds.): RSFDGrC 2005, LNAI 3641, pp. 104.113, 2005.c Springer-Verlag Berlin Heidelberg.

Hessenberg matrices and Morgan-Voyce sequences

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ABSTRACT

A recursive sequence is any sequence of numbers indexed by $n \in \mathbb{Z}$, which can be generated by solving the recurrence equation. Special number sequences such as Fibonacci, Lucas, Pell, Narayana and Morgan-Voyce are subsets of a family of recursive sequences and have been studied by mathematicians for their intrinsic theory and applications. In dealing with electrical ladder networks, Morgan-Voyce defined the two sequences $\{V_n\}$ and $\{M_n\}$ by

$$V_n = (2+t)V_{n-1} - V_{n-2}, \quad V_0 = 1, V_1 = 1, n \geq 2$$
$$M_n = (2+t)M_{n-1} - M_{n-2}, \quad M_0 = 0,\ M_1 = 1, n \geq 2$$

where t is a parameter that we assume to be in $\mathbb{Z}$.

On the other hand, computations of determinants and permanents have taken so much interest for these number sequences. In matrix theory, determinant and permanent are two importance consepts. It is known that there are a lot of relations between determinants or permanents of matrices and well-known number sequences. Determinants and permanents have many applications in physics, chemistry, electrical engineering, and so on.

In this paper, we examine Hessenberg matrices and Morgan-Voyce sequences $\{V_n\}$ and $\{M_n\}$. We define some $n \times n$ Hessenberg matrices with applications to Morgan-Voyce sequences $\{V_n\}$ and $\{M_n\}$ and then we show that determinants and permanents of these Hessenberg matrices give terms of Morgan-Voyce sequences $\{V_n\}$ and $\{M_n\}$.

Key Words: Morgan-Voyce sequence, Determinant, Permanent, Hessenberg matrix.

REFERENCES

[1] A.M. Morgan-Voyce, Ladder Networks Analysis Using Fibonacci Numbers, I.R.E. Trans. Circuit Theory 63, (1959), 321-322.

[2] R. Brualdi, P. Gibson, Convex polyhedra of doubly stochastic matrices. I. Applications of the permanent function, J. Comb. Theory 22(2), (1977), 194-230.

[3] A.F. Horadam, Unit Coefficient Sums for Certain Morgan-Voyce Numbers, Notes on Number Theory and Discrete Mathematics 3.3, (1997), 117-27.

[4] N. D. Cahill, J. R. D'Errico, D. A. Narayan and J. Y. Narayan, Fibonacci determinants, College Math. J. 33(3), (2002), 221-225.

[5] A. A. Ocal, N. Tuglu, E. Altinisik, On the representation of k-generalized Fibonacci and Lucas numbers, Appl. Math. Comput., 170(1), (2005), 584-596.

Determinants and permanents of Hessenberg matrices with Fibonacci-like sequences

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ABSTRACT

Sequences of integer numbers, such as the Fibonacci, Lucas, Pell, Jacobsthal and Padovan sequences are well-known second order recurrence sequences. These number sequences contribute significantly to mathematics, especially to the field of number theory. Fibonacci sequence is defined by the recurrence relation $F_n = F_{n-1} + F_{n-2}$, $n \geq 2$ and $F_0 = 0$, $F_1 = 1$ where F_n is a nth number of sequence. Many authors have been defined Fibonacci pattern based sequences which are popularized and known as Fibonacci-Like sequences.

Many properties of these number sequences are deduced directly from elemantary matrix algebra. Determinants and permanents have many applications in physics, chemistry, electrical engineering, and so on. In matrix algebra, computations of determinants and permanents have a great importance in many branches of mathematics. There are a lot of relationships between determinantal and permanentel representations of matrices and well-known number sequences.

In this paper, we consider Hessenberg matrices and Fibonacci-Like sequences. We firstly define some $n \times n$ Hessenberg matrices to Fibonacci-Like sequences that is defined by the recurrence relation $T_n = T_{n-1} + T_{n-2}$, $n \geq 2$ and $T_0 = m$, $T_1 = m$ where m is a fixed positive integer and investigate the determinantal and permanental properties. Also, we obtain that the determinants and permanents of these Hessenberg matrices are terms of Fibonacci-Like sequences.

Key Words: Fibonacci sequence, Lucas sequence, Hessenberg matrix.

REFERENCES

[1] R. Brualdi, P. Gibson, Convex polyhedra of doubly stochastic matrices. I. Applications of the permanent function, J. Comb. Theory 22(2), (1977), 194-230.

[2] N. D. Cahill, J. R. D'Errico, D. A. Narayan and J. Y. Narayan, Fibonacci determinants, College Math. J. 33(3), (2002), 221-225.

[3] A. A. Ocal, N. Tuglu, E. Altinisik, On the representation of k-generalized Fibonacci and Lucas numbers, Appl. Math. Comput., 170(1), (2005), 584-596.

[4] B. Singh, O. Sikhwal and S. Bhatnagar, Fibonacci-Like sequence and Its Properties, Int. J. Contemp. Math. Sciences, 5(18), (2010), 859-868.

[5] A. A. Wani, O.P. Sikhwal, K. Sisodiya, Relations among Fibonacci, Lucas and Fibonacci-Like Sequences, International Journal of Recent Trends in Engineering & Research, 2(9), (2016), 125-136.

On rings whose units and nilpotent elements satisfy some equations

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ABSTRACT

For an associative ring R, the set of all units, the Jacobson radical and the set of all nilpotent elements of R are denoted by $U(R)$, $J(R)$ and $N(R)$, respectively.

In this presentation, we talk about the following equations related this notations: $1+J(R)=U(R)$ and $1+N(R)=U(R)$. Firstly, we remark that $1+J(R)\subseteq U(R)$ and $1+N(R)\subseteq U(R)$ always hold. In (Calugareanu 2015), a ring which satisfies the equation $1+N(R)=U(R)$ is called a UU-ring (units are unipotent). A ring which satisfies the equation $1+J(R)=U(R)$ is called UJ-ring (Koşan, Leroy and Matczuk 2018). If the endomorfizm ring of a right R-module M is a UJ-ring then M is called a UJ-module (see, Sa and Yıldırım).

Let us remark that $1+n+j\in U(R)$ for any elements $n\in N(R)$ and $j\in J(R)$. This offers us the natural equation and hence the definition: A ring R is a UNJ-ring if $1+N(R)+J(R)=U(R)$ (Koşan, Quynh and Zemlicka). After presenting several properties and characterizations of UU, UJ and UNJ-rings, we discuss these notations within many well-studied classes of rings: Dedekind finite rings, 2-primal rings, clean rings, J-clean rings, (semi)regular rings, Booelan rings and group rings.

Key Words: UU-rings, UJ-rings, UNJ-rings.

MSC : 16N20, 16D60, 16U60, 16W10.

REFERENCES

[1] G.Calugareanu, UU-rings, Carpethian J. Math. 31(2) (2015) 157-163.

[2] M.T. Koşan, A. Leroy, J. Matczuk, On UJ-rings, Commun. Algebra 46(5) (2018) 2297-2303.

[3] S.Sa and T.Yıldırım, UJ-endomorphism rings, The Mathematica Journal 60(83) (2018) 186-198.

[4] M.T.Koşan, T.C.Quyng, J.Zemlicka: UNJ-rings, to appear in J. Algebra and App.

Random generation in the Nottingham group

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ABSTRACT

The Nottingham group can be defined as the group of formal power series with leading term x, under formal substitution. It was first investigated by number theorists, and then it was shown to play a significant role in the theory of pro-p groups. For instance, The Nottingham group and some of its subgroups are just infinite (Ershov 2004), that is, any non-trivial closed normal subgroup is of finite index. Just infinite pro-p groups are the simple objects of the category of pro-p groups. Moreover, R. Camina (Camina 1997) proved that the Nottingham group, over a field of characteristic p, contains an isomorphic copy of every finitely generated pro-p group.

Every pro-p group can be viewed as a probabilistic space with respect to the normalized Haar Measure. Let G be a profinite group. Let $Q(G,k)$ denote the probability that k randomly chosen elements of G topologically generate an open subgroup of G. A. Shalev (Shalev 2000) pointed out that if $Q(G,k) = 1$ then the lower rank of G is at most k. It is still not known whether the converse is true or not. For $p \geq 3$, the lower rank of n is 2, see (Camina 2000). Following the relation between the lower rank and the random generation, Shalev (Shalev 2000) conjectured that: "Any two random elements of the Nottingham group generate an open subgroup with probability 1".

In this talk, we will prove that this conjecture is true if we restrict ourselves to some extra conditions. We use linear algebraic and probabilistic methods, which makes our work accessible to a large audience of mathematicians.

Key Words: Nottingham group, pro-p groups, random generation.

MSC: 20E18, 20F12, 20F69.

REFERENCES

[1] R. Camina, Subgroups of the Nottingham group, J. Algebra, 196(1), pp. 101-113, 1997.

[2] R. Camina, The Nottingham group, In: New Horizons in pro-p Groups, editor: M. du Sautoy, D. Segal and A. Shalev, Birkhäuser, Basel, pp. 205—221, 2000.

[3] A. Shalev, Lie Methods in the Theory of pro-p Groups, In: New Horizons in pro-p Groups, editor: M. du Sautoy, D. Segal and A. Shalev, Birkhäuser, Basel, pp. 1—57, 2000.

[4] M. Ershov, New just-infinite pro-p groups of finite width and subgroups of the Nottingham group, J. Algebra, 275(1), pp. 419-449, 2004.

On the Mahler expansions of some p-adic trigonometric functions

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ABSTRACT

Let *p* be a fixed prime number. Throughout this work by $\mathbb{Z}_p$, $\mathbb{Q}_p$ and $\mathbb{C}_p$ we denote the ring of *p*-adic integers, the field of *p*-adic numbers and the completion of the algebraic closure of $\mathbb{Q}_p$, respectively. We note that the field of *p*-adic numbers $\mathbb{Q}_p$ is the completion of the field of rational numbers $\mathbb{Q}$ with respect to the p-adic norm $|\cdot|_p$ which is non-archimedean [2,3].

As the real case, for every continuous function can be approximated by a polynomial functions. But in p −adic case, the situation is more simple. In fact, for every $f \in C(\mathbb{Z}_p \to \mathbb{C}_p)$ can be written in the form of

$$f(x) = \sum_{n=0}^{\infty} a_n \binom{x}{n}$$

where $\binom{x}{n}$ is the binomial coefficient (a polynomial of degree *n*) means that it is defined by

$$\binom{x}{0} = 1, \; \binom{x}{n} = \frac{x(x-1)\cdots(x-n+1)}{n!} (n \geq 1)$$

for $x \in \mathbb{Z}_p$ and $n \in \mathbb{N}$. This expansion is called the Mahler expansion of *f*. The numbers a_n are determined by formula

$$a_n = \sum_{k=0}^{n} (-1)^k \binom{n}{k} f(n-k), \quad (n = 0,1,2,\ldots)$$

and they are called the Mahler coefficients of *f* [1-3]

The Volkenborn of a function $f : \mathbb{Z}_p \to \mathbb{C}_p$ is defined by the limit, if there exists (see [1-5])

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$$\int_{\mathbb{Z}_p} f(x)dx = \lim_{n\to\infty} p^{-n} \sum_{k=0}^{p^n-1} f(k)$$

The p-adic Bernoulli numbers are defined by the Volkenborn integral of x^n:

$$B_n = \int_{\mathbb{Z}_p} x^n dx \quad (n = 0,1,2,\cdots)$$

In this work, we consider some p-adic trigonometric functions. In the p-adic context the elementary functions are generally defined by power series, but their convergence regions are different from the real case. We note that a power series $f(x) = \sum_{n=0}^{\infty} a_n x^n$ with $a_n \in \mathbb{C}_p$ converges if and only if $\left|a_n x^n\right|_p \to 0$, as $n \to \infty$.

In the present work we obtain the Mahler expansions of some *p*-adic trigonometric functions and we calculate their Mahler coefficients. In addition, we obtain some results related to Volkenborn integrals and others *p*-adic integrals of these functions and *p*-adic Bernoulli numbers. For example, the following results are obtained for the p-adic hyperbolic function:

Theorem 1: Let p be an odd prime number, $a \in p\mathbb{Z}_p$ and

$$\sinh(ax) = \sum_{n=0}^{\infty} a_n \binom{x}{n} \quad (x \in \mathbb{Z}_p)$$

Then, the Mahler coefficients a_n have the form of

$$a_{2n} = \frac{1}{2}\frac{(expa-1)^{2n}.[(expa)^{2n}-1]}{(expa)^{2n}}$$

$$a_{2n+1} = \frac{1}{2}\frac{(expa-1)^{2n+1}.[(expa)^{2n+1}+1]}{(expa)^{2n+1}}$$

Theorem 2: The Mahler coefficients a_n of $\sinh(ax)$ are given as

$$a_m = \sum_{n=m}^{\infty} \frac{a^{2n+1}}{(2n+1)!} a_{m,n}$$

where the numbers $a_{m,n}$ are the Stirling number of the second kind.

Theorem 3. Let $x \in \mathbb{Z}_p,\ a \in E\ ve\ x \neq 0$. Then, the Volkenborn integral of $\sinh(ax)$ is

$$\int_{\mathbb{Z}_p} \sinh(ax)\,dx = -\frac{a}{2}$$

Similar results are discussed for other *p*-adic trigonometric functions.

Key Words: p-adic number, *p*-adic trigonometric functions, Mahler base, Mahler coefficient, Volkenborn integral, p-adic Bernoulli numbers.

MSC : 11S80, 11E95.

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REFERENCES

[1] K. Mahler, An interpolation series for continuous functions of a *p*-adic variable, *J. Reine Angew. Math.*199 23–34, 1958.

[2] A. M. Robert, A course in *p*-adic analysis, Graduate Texts in Mathematics, 198. *Springer-Verlag, New York,* 2000.

[3] W.H. Schikhof, Ultrametric calculus. An introduction to *p*-adic analysis.Cambridge Studies in Advanced Mathematics, 4. *Cambridge University Press, Cambridge,* 1984.

[4] A. Volkenborn, Ein p-adisches Integral und seine Anwendungen I. (German) *Manuscripta Math.* 7, 341–373, 1972.

[5] A. Volkenborn, Ein *p*-adisches Integral und seine Anwendungen II. (German) *Manuscripta Math.,* 12, 17–46, 1974.

A study on a graph product over algebraic graph structure

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ABSTRACT

Algebra and algebraic structures are very important for graph theory. Each commutative ring R can be described by means of a simple graph $\Gamma(R)$. There are many studies in the literature about zero-divisor graphs (Beck 1998, Anderson and Badawi, 2002, DeMeyer and DeMeyer 2005).

Also graph products are very important for graph theory. There are many papers in the literature about graph products. (Klavzar and Hong-Gwa, 2002)

In 1988, Beck introduced the notion of the zero-divisor graph $\Gamma(R)$ of a commutative ring R. Let R be a commutative ring with identity, and let Z(R) be the set of its zero-divisors. Then the zero-divisor graph $\Gamma(R)$ is actually an (undirected) graph with vertices $x, y \in Z(R)^* = Z(R)\setminus\{0\}$ such that x and y are adjacent if and only if
$xy = 0$. (Beck, 1988). After Beck's paper, zero-divisor graphs over commutative and non-commutative rings have been studied largely in terms of all graph parameters and properties (Akgunes and Togan, 2012).

Recently (Das et al. 2013), the graph $\Gamma(S_M)$ is defined by changing the adjacement rule of vertices and not destroying the main idea. Detailed, the authors considered a finite multiplicative monogenic semigroup with zero as the set

$$S_M = \{0,x,x^2,x^3,\cdots,x^n\}.$$

Then, by following the definition given in (DeMeyer and DeMeyer, 2005), it has been obtained an undirected (zero-divisor) graph $\Gamma(S_M)$ associated to S_M as in the following. The vertices of the graph are labeled by the nonzero zero-divisors (in other words, all nonzero element) of S_M, and any two distinct vertices x^i and x^j, where $(1\leq i,j\leq n)$ are connected by an edge in case $x^i.x^j = 0$ with the rule $x^i.x^j = x^{i+j} = 0$ if and only if $i+j\geq n+1$.

It is known that studying the extension of graphs is also an important tool, since there are so many applications in sicences. With this idea, it is defined thedisjunctive product $G_1 \vee G_2$ of any two simple graphs G_1 and G_2 which has the

vertex set $V(G_1)\times V(G_2)$ such that any two vertices $u=(u_1,u_2)$ and $v=(v_1,v_2)$ are connected to by an edge either $u_1v_1\in E(G_1)$ or $u_2v_2\in E(G_2)$ (see, for instance Klavzar and Hong-Gwa, 2002)

In this study, by considering monogenic semigroup graphs and disjunctive product, it will be investigated some special parameters and some special graph numbers. The obtained results are supported by special examples.

Key Words: Algebraic graph, graph product, graph numbers.

MSC : 05,15.

REFERENCES

[1] I. Beck, Coloring of Commutating Rings, J. Algebra 116, 208-226, 1988.

[2] D. F. Anderson, A. Badawi, On the Zero-Divisor Graph of a Ring, Communications in Algebra 36 (8), 3073-3092, 2008.

[3] N. Akgunes, M. Togan, Some graph theoretical properties over zero-divisor graphs of special finite commutative rings, Adv. Studies Contemp. Math. 22(2), 305-315, 2012.

[4] S. Klavžar and Y. Hong-Gwa, On the fractional chromatic number, the chromatic number, and graph products. Discrete mathematics 247(1), 235-242, 2002.

[5] F. R. DeMeyer, L. DeMeyer, Zero-Divisor Graphs of Semigroups, J. Algebra 283, 190-198, 2005.

[6] K.Ch. Das, N. Akgunes, A.S. Cevik, "On a Graph of Monogenic Semigroup", J. Inequalties and Applications 2013:44 (2013), 13pages

ANALYSIS

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Measurement of lighting bulbs' efficiency using data envelopment analysis-frontier analyst

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ABSTRACT

This study endeavours to apply the package frontier analyst® (FA) with well-known data envelopment analysis (DEA) model to evaluate the efficiency of lighting bulb systems. This Frontier Analyst® actually designed to examine the performance (relative efficiency) of Decision-Making Units (DMUs). DEA is a non-parametric method that produces a relative ratio of weighted outputs to inputs for many and varied entities (DMUs). Paper's DMUs are the lighting bulbs.; Incandescent light bulbs, Light Emitting Diodes bulbs (LED) and Compact Fluorescent light bulbs (CFL). A constant return to scale (CRS) model that called Charnes, Cooper, and Rhodes (CCR) DEA model uses in this paper assumes that the output changes in proportion to the inputs. CCR-DEA model is used to sort bulbs depending on their efficiency with respect to their annual operating cost, kilowatts of electricity, cost per bulb, life span, light output, and carbon dioxide emissions per year. The analysis results show that, while the efficiency indexes obtained from this method (FA_DEA) provides useful measures of lighting systems' efficiency, they are significantly different. The final result of Frontier Analyst using CCR-DEA method shows that two bulbs out of three have unity (1) and classified as efficient DMUs (LED and CFL), .and the inefficient DMU is the Incandescent bulb which is the ancient type of lighting bulbs.

Key Words: Data envelopment analysis, efficiency, lighting bulbs, frontier analyst.

MSC: 46, 65.

REFERENCES

[1] O P. K. Soori and M. Vishwas, "Lighting control strategy for energy efficient office lighting system design, "Energy and Buildings, vol. 66, pp. 329–337, 2013

[2] G. Ganandran, T. M. Mahlia, H. Chyuan Ong, B. Rismanchi and W. T. Chong “Cost-Benefit Analysis and Emission Reduction of Energy Efficient Lighting at the Universiti Tenaga Nasional”

[3] Wade D. Cook, Julie Harrison, Raha Imanirad, Paul Rouse and Joe Zhu” Data Envelopment Analysis with Non-Homogeneous DMUs”, Data Envelopment Analysis, 2015.

A generalization of local uniform convexity

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ABSTRACT

Let X be a real Banach space and X^* its dual. The unit sphere of X is denoted by S_X.

The space X is said to be compactly locally uniformly rotund (in short, CLUR) if (x_n) has a convergent subsequence whenever $x, x_n \in S_X$ and $\|x_n+x\| \to 2$.

It is clear from the definitions that X is locally uniformly rotund (LUR) if and only if it is CLUR and strictly convex [3,5]. Since the concept of weakly LUR is well studied in literature [1,2], it is natural to introduce the concept of weakly CLUR as a generalization of CLUR and weakly LUR. The following definition, which is used by some authors, was introduced by Vlasov [5].

The space X is said to be WCLR if (x_n) has a weakly convergent subsequence whenever $x, x_n \in S_X$ and $\|x_n+x\| \to 2$.

It is clear that every reflexive Banach space is WCLR. However, a space which is strictly convex and reflexive need not be weakly LUR [4]. Therefore, WCLR and weakly LUR are not the same in strictly convex spaces unlike CLUR which coincides with LUR in strictly convex spaces. In this paper, we modify the definition of WCLR and introduce the notion of weakly CLUR as a generalization of weakly LUR to non-strictly convex spaces. The geometric and approximation theoretic characterizations of weakly CLUR presented in this paper indicate that the notion of weakly CLUR introduced in this paper is a natural generalization of CLUR and weakly LUR.

Key Words: Locally uniformly convex, Kadec-Klee property, Approximatively weakly compact.

MSC : 41,46

REFERENCES

[1] A. R. Lovaglia, Locally uniformly convex Banach spaces, Trans. Amer. Math. Soc. 78 (1955), 225-238.

[2] A. Molto, J. Orihuela, S. Troyanski and M. Valdivia, On weakly locally uniformly rotund Banach spaces, J. Functional Anal. 163 (1999), 252-271.

[3] J. P. Revalski and N.V. Zhivkov, Best approximation problems in compactly uniformly rotund spaces, J. Convex. Anal. 19 (2012), 1153-1166.

[4] M. A. Smith, Some examples concerning rotundity in Banach spaces, Math. Ann. 233 (1978), 155-161.

[5] L. P. Vlasov, Approximative properties of sets in normed linear spaces, Russian Math. Surveys 28 (1973), 1-66.

Approximation properties of Bernstein-Schurer operators and rate of approximation on interval [-1,1]

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ABSTRACT

This study is based on approximation theory and the aim of the approach theory is to write a function that is difficult to study in terms of another more useful function. By this way, we can study more easily with this function.

It is well known the importance of Bernstein polynomials in the approximation theory. After the Korovkin theorem the importance of Bernstein polynomials increased much more. Many generalizations and modifications made in addition studied in statistical convergence, generalizations are made in q-analysis and (p, q) -analysis.

Çilo in 2012, in her master's thesis studied the following operator:

$$C_n(f;x)=\frac{1}{2^n}\sum_{k=0}^{n}\binom{n}{k}(1+x)^k(1-x)^{n-k}f(2\frac{k}{n}-1),\ -1\le x\le 1.$$

We defined operator $G_n(x)$ as a generalization of $C_n(f;x)$ like Bernstein and Schurer operators on the interval $[-1,1]$.

$$G_n(f;x)=\frac{1}{2^{n+l}}\sum_{k=0}^{n+l}f(\frac{2k}{n}-1)\binom{n+l}{k}(1+x)^k(1-x)^{n+l-k}\ l\in N$$

Bernstein polynomials is defined as

$$B_n(f;x)=\sum_{k=0}^{n}f(\frac{k}{n})\binom{n}{k}x^k(1-x)^{n-k},\ \ x\in[0,1]$$

and $f\in C[0,1]$, on interval $[0,\infty)$. S_n : $C[0,\infty)\rightarrow C[0,\infty)$. Schurer operator is defined as

$$S_n(f;x)=e^{-nx}\sum_{k=0}^{\infty}\frac{(nx)^k}{k!}f(\frac{k}{n})$$

In this study, firstly we defined Bernstein and Schurer operators and we examined the some approximation properties of the operator $G_n(x)$, which define as a generalization of the Bernstein – Schurer operators using Korovkin theorem and then we provided the conditions of Korovkin's theorem on operator $G_n(x)$ in addition

we showed the linearity and positivity of operator $G_n(f)$ and then we estimate rate of approximation of operator $G_n(x)$ by modulus of continuity.

Key Words: Bernstein operator, modulus of continuty, Korovkin theorem.

MSC: 41A25, 41A36.

REFERENCES

[1] S.N. Bernstein (1912). Demonstration du Theorem de Weierstrass Fondee sur le Calculu des Probabilites. Comp. Comm. Soc. Mat. Charkow Ser. 13(2):1-2.

[2] P.P. Korovkin (1953). On convergence of linear positive operators in the space of continuous functions. Dokl. Akad. Nauk. 90:961-964.

[3] A. Sahaı (2011). An iterativereduced- biasa logarithm for a dual- fusion S. Variant of Bernstein operator. Inter. J. Of Math. Arch. 2(3): 331-334.

[4] H. Bohman (1952). On Approximation of Continuous and Analytic Functions. Ark. Mat. 2:43-56.

[5] G.G. Lorentz. (1953). Bernstein Polynomials. Math. Expo. vol 8, Univ. Of Toronto Press. Toronto. 8:15-217.

[6] F. Altomare. M. Campıtı. (1994). Series Studies in Mathematics. Vol. 17. Walter Korovkin-type Approximation Theory and its Applications. De Gruyder de Gruyter. Berlin. New-York.

On Fibonacci ideal convergence of double sequences in intuitionistic fuzzy normed linear spaces

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ABSTRACT

The Fibonacci sequence was initiated in the book Liber Abaci of Fibonacci. The sequence had been described earlier as Virahanka numbers in Indian mathematics. In Liber Abaci, the sequence starts with 1, nowadays the sequence begins either with $f_0=0$ or with $f_1=1$. The numbers in the bottom row are called Fibonacci numbers, and the number sequence (1,1,2,3,5,8,13,21,34,55,89,144,...) is the Fibonacci sequence (Koshy 2001).

The Fibonacci sequence was firstly used in the theory of sequence spaces by (Kara and Başarır 2012). The definition of statistical convergence with Fibonacci sequence was given by (Kirişçi 2016).

Following the introduction of fuzzy set theory by (Zadeh 1965), there has been extensive research to find applications and fuzzy analogues of the classical theories. Fuzzy logic has become an important area of research in various branches of mathematics such as metric and topological spaces, theory of functions and approximation theory. Fuzzy set theory has also found applications for modeling uncertainty and vagueness in various fields of science and engineering, such as computer programming, nonlinear dynamical systems, population dynamics, control of chaos, and quantum physics.

As a generalization of fuzzy sets, the concept of intuitionistic fuzzy sets was introduced by (Atanassov 1986), it has been extensively used in decision-making problems and in E-infinity theory of high-energy physics. The concept of an intuitionistic fuzzy metric space (IFNS for short) was introduced by (Park 2004). (Karakuş 2008) defined statistical convergence in intuitionistic fuzzy normed space and (Mursaleen and Mohiuddine 2009) investigated statistical convergence of double sequences in IFNS. Kumar and Kumar gave the notion of ideal convergence of

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sequences in IFNS. Mursaleen et. al. studied on the ideal convergence of double sequences IFNS.

(Kirişci 2019), studied the concept of Fibonacci statistical convergence on IFNS. He defined the Fibonacci statistically Cauchy sequences with respect to an intuitionisitic fuzzy normed space and introduced the Fibonacci statistical completenes with respect to an intuitionisitic fuzzy normed space. (Kişi and Debnath 2019) investigated Fibonacci ideal convergence on IFNS.

The aim of this article is to introduce and study the notion of Fibonacci ideal-convergence of double sequences on intuitionistic fuzzy normed linear space. We define the Fibonacci ideal Cauchy double sequences with respect to an intuitionistic fuzzy normed linear space and introduce the Fibonacci ideal completenes of double sequences with respect to an intuitionistic fuzzy normed linear space.

Key Words: Fibonacci *I*-convergence, Fibonacci *I*-Cauchy sequence, double sequences, intuitionistic fuzzy normed linear space

MSC : 11B39, 41A10, 41A25, 41A36, 40A30, 40G15.

REFERENCES

[1] L. A. Zadeh, Fuzzy sets, Inf. Control 8 (1965), 338-353.

[2] K. T. Atanassov, Intuitionistic fuzzy sets, Fuzzy Sets and Systems 20 (1986), 87-96.

[3] E. E. Kara, M. Başarır, An application of Fibonacci numbers into infinite Toeplitz matrices. Caspian J. Math. Sci 1(1), (2012), 43-47.

[4] T. Koshy, Fibonacci and Lucas Numbers with Applications. Wiley, New York (2001).

[5] M. Kirişçi, Fibonacci statistical convergence on intuitionistic fuzzy normed spaces, J Intell Fuzzy Syst, in press.

[6] Ö. Kişi, P. Debnath, Fibonacci ideal convergence on intuitionistic fuzzy normed spaces, under review.

[7] M. Mursaleen, S.A. Mohiuddine, H.H. Edely, On the ideal convergence of double sequences in intuitionistic fuzzy normed spaces, Comput Math Appl 59 (2010), 603-611.

[8] J. H. Park, Intuitionistic fuzzy metric spaces, Chaos Solitons Fractals 22 (2004), 1039-1046.

Deferred statistical convergence of double sequences in intuitionistic fuzzy normed linear spaces

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ABSTRACT

The concept of statistical convergence was first introduced by (Fast 1951). The first study on double sequences was examined by (Bromwich 1965). The statistical and Cauchy convergence for double sequences were examined by (Mursaleen and Edely 2003) in recent years.

The deferred Cesàro mean of sequences of real numbers was introduced by (Agnew 1932). The concepts of deferred density and deferred statistical convergence for real sequences were given by (Küçükaslan and Yılmaztürk 2016).

In (Dağadur and Sezgek 2016), the authors investigated deferred Cesàro mean and deferred statistical convergence for double sequences by using deferred double natural density of the subset of natural numbers and give some certain results for deferred Cesàro mean of double sequences and obtained some important results.

As a generalization of fuzzy sets, the concept of intuitionistic fuzzy sets was introduced by (Atanassov 1986), it has been extensively used in decision-making problems and in E-infinity theory of high-energy physics. The concept of an intuitionistic fuzzy metric space (IFNS for short) was introduced by (Park 2004). Karakuş defined statistical convergence in intuitionistic fuzzy normed space and Mursaleen and Mohiuddine investigated statistical convergence of double sequences in IFNS.

In this study, the intuitionistic fuzzy deferred statistical convergence of double sequences in the intuitionistic fuzzy normed space is defined by considering deferred density given in (Küçükaslan and M. Yılmaztürk 2016).

Besides the main properties of this new method, it is compared with intuitionistic fuzzy statistical convergence of double sequences and itself under different restrictions on the method. Some special cases of the obtained results are coincided with known results in literature.

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Key Words: Intuitionistic fuzzy deferred convergence, Intuitionistic fuzzy deferred statistical convergence

MSC : 03E72, 40A35

REFERENCES

[1] H. Fast, Sur La Convergence Statistique, Colloq. Math. 2, (1951) 241-244.

[2] T.J. Bromwich: An Introduction to The Theory of In_nite Series , Macmillan and Co. Ltd., New York (1965).

[3] M. Mursaleen, Osama H.H. Edely, Statistical Convergence of Double sequences, J.Math. Anal. Appl. 288 (2003) 223-231.

[4] R,P. Agnew, On Deferred Cesaro Means, Ann. of Math. 33 (1932) 413-421. T. Koshy, Fibonacci and Lucas Numbers with Applications. Wiley, New York (2001).

[5] M. Küçükaslan and M. Yılmaztürk, On deferred statistical convergence of sequences, Kyungpook Math J 56 (2016), 357–366.

[6] İ. Dağadur, Ş. Sezgek, Deferred Cesaro mean and deferred statistical convergence of double sequences, Journal of Inequalities and Special Functions, 7 (4), (2016), 118-136.L. A. Zadeh, Fuzzy sets, Inf. Control 8 (1965), 338-353.

[7] K.T. Atanassov, Intuitionistic fuzzy sets, Fuzzy Sets and Systems 20 (1986), 87-96.

[8] J.H. Park, Intuitionistic fuzzy metric spaces, Chaos Solitons Fractals 22 (2004), 1039-1046.

Fourier-Bessel transforms of Dini-Lipschitz functions on Lebesgue Spaces $\mathbf{L}_{\mathbf{p},\boldsymbol{\gamma}}(\mathbb{R}_+^{\mathbf{n}})$

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ABSTRACT

As it is well known that if Lipschitz conditions are applied on a function $f(x)$, then these conditions greatly affect the absolute convergence of the Fourier series and behaviour of $\mathcal{F}_\mathrm{B}\mathrm{f}$ Fourier Bessel transforms of f. In general, if $f(x)$ belongs to a certain function class, then the Lipschitz conditions have bearing as to the dual space to which the Fourier coefficients and Fourier Bessel transforms of $f(x)$ belong. Younis [8] worked the same phenomena for the wider Dini Lipschitz class for some classes of functions. Daher, El Quadih, Daher and El Hamma proved an analog Younis [8, Theorem 2.5] in for the Fourier Bessel transform for functions satisfies the Fourier Bessel Dini Lipschitz condition in the Lebesgue space $\mathrm{L}^2_{\alpha,\mathrm{n}}$ [3]. El Hamma and Daher obtain a generalized of Titchmarsh's theorem for the Bessel transform in the space $\mathrm{L}_{\mathrm{p},\alpha}(\mathbb{R}_+)$ [2]. In this study, using a generalized shift operator, defined by Levitan [6], generated by Bessel operator $\mathrm{B_i} = \frac{\partial^2}{\partial \mathrm{x_i^2}} + \frac{\gamma_\mathrm{i}}{\mathrm{x_i}}\frac{\partial}{\partial \mathrm{x_i}}$, $\mathrm{i} = 1,\ldots,\mathrm{n}$, we generalize Younis's theorem [8, Theorem 2.5] in for the Fourier Bessel transform for functions satisfies the Fourier Bessel Dini Lipschitz condition in the Lebesgue space $\mathrm{L}_{\mathrm{p},\gamma}(\mathbb{R}_+^\mathrm{n})$. In this study, we also obtain an analogy of one classical Titchmarsh's theorem on description of the image under the Fourier transform of a class of functions satisfying the (ψ, p)-Bessel Lipschitz condition in $\mathrm{L}_{\mathrm{p},\gamma}(\mathbb{R}_+^\mathrm{n})$.

Key Words: Bessel generalized translation, Bessel operator, Fourier-Bessel transform.

Mathematics Subject Classification: 42B10.

REFERENCES

[1] V.A. Abilov, F.V. Abilova, M.K. Kerimov, On Estimates for the Fourier-Bessel Integral Transform in the Space, $\mathrm{L}_2(\mathbb{R}_+)$, Zh. Vychisl. Mat. Mat. Fiz., 2009.

[2] M. El Hamma, R. Daher, Generalization of Titchmarsh's Theorem for the Bessel transform, Rom. J. Math. Comput. Sci., 2012.

[3] S. El Quadih, R. Daher, M. El Hamma, Generalization of Titchmarsh's Theorem for the Generalized Fourier-Bessel Transform in the Space $\mathrm{L}^2_{\alpha,\mathrm{n}}$, International Journal of Mathematical Modelling Computations, 6(3), 2016, 253-260.

[4] I.A. Kipriyanov, Fourier-Bessel transformations and imbedding theorems, Trudy Math. Inst. Steklov, 1967.

[5] B.M. Levitan, Bessel function expansions in series and Fourier integrals, Uspekhi Mat. Nauk, 1951.

[6] B.M. Levitan, Expansion in Fourier series and integrals over Bessel functions, Uspekhi Mat. Nauk, 1951.

[7] K. Trimèche, Transmutation operators and mean-periodic functions associated with differential operators, Math. Rep., 1988.

[8] M.S. Younis, Fourier transforms of Dini-Lipschitz functions, Internat. J. Math. & Math. Sci., 9(2), 1986, 301-312.

A note on a Banach algebra

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ABSTRACT

The first appearance of amalgam spaces can be traced to Norbert Wiener in his development of the theory of generalized harmonic analysis. Wiener amalgam spaces are a class of spaces of functions or distributions defined by a norm which amalgamates a local criterion for membership in the space with a global criterion. The amalgam of Lp and lq on the real line is the space consisting of functions which are locally in Lp and have lq behaviour at infinity. Wiener studied several special cases of amalgam spaces. Time-frequency analysis is a modern branch of harmonic analysis. It has many applications in signal analysis and wireless communication. Time-frequency analysis is a form of local Fourier analysis that treats time and frequency simultaneously. Inspired by this idea, modulation and Wiener amalgam spaces have been introduced and used to measure the time-frequency concentration of a function or a tempered distribution. During the last ten years, these two function spaces have not only become useful function spaces for time-frequency analysis, they have also been employed to study boundedness properties of pseudo-differential operators, Fourier multipliers, Fourier integral operators, and well-posedness of solutions to PDEs. In this study we recall the classical amalgam space on IR. We will also show that the amalgam space is a Segal algebra using the Hardy-Littlewood maximal operator.

Key Words: Amalgam space, Hardy-Littlewood maximal operator, Segal algebra.

MSC: 28,30,43,46.

REFERENCES

[1] F. Holland, Harmonic analysis on amalgams of Lp and lq, J. London Math. Soc. 2, 10, (1975), 295-305.

[2] J. J. Fournier, J. Stewart, Amalgams of Lp and lq, Bull. Amer. Math. Soc., vol. 13, 1, (1985) ,1-21.

[3] N. Wiener, On the representation of functions by trigonometrical integrals, Math. Z., Vol. 24, (1926), 575-616.

Convergence theorems for non-expansive mappings in CAT(0) space and an application

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ABSTRACT

There exists an extensive literature on the iterative fixed points for various classes of mappings which includes applications in convex optimization, differential inclusions, fractals, discontinuous differential equations, optimal control, computing homology of maps, computer assisted proofs in dynamics, digital imaging and economics. In recent years, different iterative processes have been used to approximate the fixed points of multivalued mappings. Here, it can be mentioned that approximating the common fixed points has its own importance as it has a direct link with the minimization problem. Several researchers investigated the problem of image recovery by convex combinations of non-expansive retractions in a uniformly convex Banach space. This problem has been investigated by many authors via several iteration schemes in linear spaces.

The aim of present paper is to introduce a new iterative process involving a finite family of multivalued non-expansive mappings in CAT(0) spaces. We prove some Δ-convergence and strong convergence theorems for the proposed scheme with and without end point conditions. The newly defined iteration scheme is also utilized to an application in image recovery problem. In process, our results generalize and extend the corresponding results of Uddin et al., Abbas et al., Eslamian and Abkar, Bunyawat and Suantai, Khan, Khan and Fukhar-ud-din and Fukhar-ud-din and Khan and references cited therein.

Key Words: CAT(0) space, Fixed point, Δ-convergence, Opial's property and Image recovery problem.

MSC: 47, 54.

REFERENCES

[1] I. Uddin, J. Ali, J.J. Nieto, An iteration scheme for a family of multi-valued mappings in CAT(0) spaces with an application to image recovery, RACSAM 112(2018), 373-384.

[2] S.B. Nadler Jr., Multivalued contraction mappings, Pacific J. Math. 30(1969), 475-488.

[3] J.J. Nieto and R. Rodriguez-Lopez, Contractive mapping theorems in partially ordered sets and applications to ordinary differential equations, Order 22(2005), 223-239.

[4] T.C. Lim, A fixed point theorem for multivalued nonexpansive mappings in a uniformly convex Banach spaces, Bull. Amer. Math. Soc. 80(1974), 1123-1126.

[5] K. Goebel and W.A. Kirk, Iteration process for nonexpansive mappings, Contemp. Math. 21 (1983), 115-123.

On *q*- Meyer-König and Zeller operators

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ABSTRACT

Korovkin type theorems play a central role in approximation theory. After, Gadjiev and Orhan proved a Korovkin type theorem for sequences of linear positive via statistical convergence, many reseachers have investigated Korovkin type theorems with various motivations considering some summability methods [2].

Now, let us recall Abel method which is defined by power series. Let $x=(x_j)$ be a real sequence. If the series

$$\sum_{j=0}^{\infty} x_j y_j$$

is convergent for any $y \in (0,1)$ and

$$\lim_{y\to 1^-}(1-y)\sum_{j=0}^{\infty} x_j y_j = \alpha$$

then *x* is said to be Abel convergent to real number *α* [1]. Korovkin type approximation theorem via Abel convergence proved in [4].

Trif [3] defined the *q*- generalization of the Meyer-König and Zeller operators as

$$M_n^q(f;x)=\begin{cases}\prod_{j=0}^{n}(1-q^j x)\sum_{k=0}^{\infty} f\left(\frac{[k]}{[n+k]}\right)\begin{bmatrix} n+k \\ k\end{bmatrix} x^k, & 0\le x<1\\ f(1), & x=1\end{cases}$$

For all $f\in C[0,1], x\in[0,1], q\in(0,1]$. In order to study Korovkin type approximation properties, the author obtained the moments of these operatos in the following

$$M_n^q(1;x)=1,$$
$$M_n^q(t;x)=x,$$
$$x^2\le M_n^q(t^2;x)\le \frac{x}{[n-1]}+x^2.$$

In this talk, we consider *q*-Meyer-König and Zeller operators and mention about some approximation properties of these operators. Moreover, taking into account the Abel convergence, We give some approximation results. We also compute rate of the Abel

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convergence for these operators. Finally, we show that the results obtained in this work is stronger than some previous results.

Key Words: *q*-Meyer-König-Zeller operators, Abel convergence, rate of convergence.

MSC: 40A35, 41A36.

REFERENCES

[1] R. E. Powell,. and S. M. Shah, Summability Theory and Its Applications, Prentice-Hall of India, New Delhi, 1988.

[2] D. Söylemez, and M. Ünver, Korovkin type theorems for Cheney--Sharma Operators via summability methods, Res. Math., 73(3)(2017), 1601-1612.

[3] T. Trif, Meyer-König and Zeller operators based on the q-integers, Rev. Anal. Numer. Theor. Approx., 29(2000), 221-229.

[4] M. Ünver, Abel transforms of positive linear operators. In: ICNAAM 2013. AIP Conference Proceedings, 1558 (2013), 1148-1151.

Vector-valued weighted Sobolev spaces with variable exponent

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ABSTRACT

Spaces of weakly differentiable functions, so called Sobolev spaces, play an important role in modern Analysis. Since their discovery by Sergei Sobolev in the 1930's they have become the base for the study of many subjects such as partial differentiable equations and calculus of variations. Vector-valued Lebesgue and Sobolev spaces are now widely used in analysis, abstract evolution equations and in the theory of integral operators. Also, the use of theory of vector-valued Sobolev spaces can be applied for solutions of some elliptic partial differential equations, new embedding results for weighted Sobolev spaces. The variable exponent Lebesgue space and Sobolev space were introduced by Kováčik and Rákosník in 1991. Since 1991, variable exponent Lebesgue, Sobolev, Besov, Triebel-Lizorkin, Lorentz, amalgam and Morrey spaces, have attracted many attentions. Vector-valued variable exponent Bochner-Lebesgue spaces defined by Cheng and Xu in 2013. They proved dual space, the reflexivity, uniformly convexity and uniformly smoothness of this space. Furthermore, they gave some properties of the Banach valued Bochner-Sobolev spaces with variable exponent. In this study, we focus on vector-valued weighted variable exponent Lebesgue and Sobolev spaces, and discuss some basic properties, such as completeness, separable, reflexive and uniformly convex. Our aim is to introduce the vector-valued weighted variable exponent Lebesgue spaces. We discuss two different type of Hölder inequalities in this spaces. We will also show that every elements of vector-valued weighted variable exponent Lebesgue spaces are locally integrable. Hence we can define vector-valued weighted variable exponent Sobolev spaces. Finally under some conditions we will investigate some basic properties of vector-valued weighted variable exponent Sobolev spaces.

Key Words: Vector-valued variable exponent Lebesgue and Sobolev spaces, Hölder inequality, Radon-Nikodym property.

MSC: 28,30,43,46.

REFERENCES

[1] H. Amann, Linear and quasilinear parabolic problems, Vol.I : Absract Linear Theory, Birkhäuser Basel, 1995.

[2] C. Cheng, J. Xu, Geometric properties of Banach space valued Bochner-Lebesgue spaces with variable exponent, J Math Inequal, Vol.7(3), (2013), 461-475.

[3] O. Kováčik, J. Rákosník, On spaces L^{p(x)} and W^{k,p(x)}, Czech. Math. J., 41, 116, (1991), 592-618.

A generalized hyperbolic smoothing approach for non-smooth and Non-Lipschitz functions

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ABSTRACT

A growing interest on the problems of non-smooth optimization is due to many applications in engineering, finance, medical and other sciences. They have been transformed into well-known optimization problems such as regularization, eigenvalue, min-max, min-sum-min problems [1,2,3]. One of the important approaches to solve these problems is smoothing techniques. The main idea of these studies is based on approximating the non-smooth objective function by smooth functions. After the approximation process the differentiation based methods are used to minimize the smoothed function.

Two important classes of smoothing techniques become prominent. The first one is called as local smoothing which is depend on constructing smooth approximation to the original function in a suitable neighbourhood of the kink points. The second one is called global smoothing and it depends on approximating the original function on whole domain by using some specially designed smooth functions [4]. The hyperbolic smoothing approach is one of important one among the global smoothing techniques [5].

In this study, we investigate the generalization of the hyperbolic smoothing techniques for some sub-classes of non-Lipschitz functions. We present some useful properties of this smoothing technique on very well-known optimization problems. The effectiveness of the new technique is illustrated on the example. Finally, we apply the hyperbolic smoothing technique in solving some regularization problems.

Key Words: Nonsmooth optimization, non-Lipschtiz functions, hyperbolic smoothing.

MSC: 65, 90, 49, 26.

REFERENCES

[1] A. E. Xavier, Optimal Covering of Plane Domains by Circles via Hyperbolic Smoothing, J. Global Optim., 31 (2005) 493-504.

[2] A. E. Xavier, The Hyperbolic Smoothing Clustering Method, Patt. Recog., 43 (2010) 731-737.

[3] X. Chen, Smoothing Methods for Nonsmooth, Nonconvex Minimization, Math. Prog. Ser. B, 134 (2012) 71-99.

[4] A. Sahiner, G. Kapusuz, N. Yilmaz, A New Smoothing Approach to Exact Penalty Functions for Inequality Constrained Optimizaiton Problems, Numer. Algebra Contol Optim. 6 (2) (2016) 161-173.

[5] A. M. Bagirov, A. Al Nuamiat, N. Sultanova, Hyperbolic Smoothing Functions for Nonsmooth Minimization, Optimization, 62:6 (2013) 759-782.

Quadruple band matrix and almost convergence

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ABSTRACT

By w, we denote the family of all real(or complex) valued sequences. w is a vector space under point-wise addition and scalar multiplication. Every vector subspace of w is called a sequence space. We use the notations of f, f_0 and fs for the space of all almost convergent sequences, almost null sequences and almost convergent series, respectively.

A Banach sequence space X is called a BK-space provided each of the maps $p_n: X \longrightarrow \mathbb{C}$ defined by $p_n(x) = x_n$ is continuous for all $n \in \mathbb{N}$.

Let $A = (a_{nk})$ be an infinite matrix of complex numbers, X and Y be two arbitrary sequence spaces and $x = (x_k) \in w$, then the A-transform of x is defined by $(Ax)_n = \sum_{k=0}^{\infty} a_{nk} x_k$ and is assumed to be convergent for all $n \in \mathbb{N}$. The domain of A is defined by $X_A = \{x = (x_k) \in w : Ax \in X\}$ and the class of all matrices such that $X \subset Y_A$ is denoted by $(X:Y)$.

Given a normed space $(X, \|.\|_X)$, a sequence $b = (b_k)$ is called a Schauder basis for X if for all $x \in X$ there exists a unique sequence of scalars $\alpha = (\alpha_k)$ such that $\lim_{n\to\infty} \|x - (\alpha_1 b_1 + \alpha_2 b_2 + \cdots + \alpha_n b_n)\|_X = 0$.

In this work, we construct the sequence spaces $f(Q(r,s,t,u))$, $f_0(Q(r,s,t,u))$ and $fs(Q(r,s,t,u))$ by using the domain of quadruple band matrix $Q = Q(r,s,t,u)$, which generalizes the matrices Δ^3, $B(r,s,t)$, Δ^2, $B(r,s)$ and Δ, where Δ^3, $B(r,s,t)$, Δ^2, $B(r,s)$ and Δ are called third order difference, triple band, second order difference, double band and difference matrix, respectively. Moreover, we show that these spaces are BK-spaces and are linearly isomorphic to the sequence spaces f, f_0 and fs, respectively. Also, we give the Schauder basis and β-, γ-duals of those spaces. Lastly, we determine some matrix classes related to those spaces.

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Key Words: Matrix Domain, Almost Convergence, β-And γ-Duals.

MSC: 40C05, 40H05.

REFERENCES

[1] H. Kızmaz, On certain sequence spaces, Canad. Math. Bull., **24**(2), 169-176, 1981.

[2] F. Başar, M. Kirişçi, Almost convergence and generalized difference matrix, Comput. Math. Appl., **61**(3), 602-611, 2011.

[3] A. Sönmez, Almost convergence and triple band matrix, Math. Comput, Model., **57**(10), 2393-2402, 2013.

Weighted lacunary statistical convergence and its applications

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ABSTRACT

Let $\mathbb{N}$ be the set of all natural numbers and $K \subset \mathbb{N}$. Let $K_n = \{k \leq n: k \in K\}$. The natural density of K is defined by

$$\delta(K) = \lim_{n\to\infty} \frac{1}{n} |K_n|$$

if the limit exists, where the vertical bars indicate the number of elements in the enclosed set. Then, the sequence $x = (x_k)$ is said to be statistically convergent to a number L if for every $\varepsilon > 0$, the set $K_\varepsilon := \{k\epsilon\mathbb{N}: |x_k - L| \geq \varepsilon\}$ has natural density zero, i.e. for each $\varepsilon > 0$

$$\lim_{n\to\infty} \frac{1}{n} |\{k \leq n: |x_k - L| \geq \varepsilon\}| = 0$$

(Fast 1951, Steinhaus 1951).

Over years, statistical convergence has become an area of active research and has been discussed in the theory of Fourier analysis, ergodic theory, number theory and approximation theory. Later on, Fridy and Orhan (1993) introduced the concept of lacunary statistical convergence as follows:

Let $\theta = (k_r)$ is called a lacunary sequence if θ be the sequence of positive integers such that $k_0 = 0,\ 0 < k_r < k_{r+1}$ and $h_r = k_r - k_{r-1} \to \infty$ as $r \to \infty$. The intervals determined by θ are denoted by $I_r = (k_{r-1}, k_r]$. The ratio $\frac{k_r}{k_{r-1}}$ will be denoted by q_r. A sequence $x = (x_k)$ is said to be lacunary statistically convergent to a number α if for every $\varepsilon > 0$,

$$\lim_{r\to\infty} \frac{1}{h_r} |\{k\epsilon I_r: |x_k - \alpha| \geq \varepsilon\}| = 0$$

(Fridy and Orhan 1993).

The concept of weighted statistical convergence was first introduced by Karakaya and Chishti (2009). After that, a modified version was given by Mursaleen et all (Mursaleen,Karakaya, Ertürk and Gürsoy 2012).

Let (p_k) be a sequence of nonnegative numbers such that $p_0 > 0$ and $P_n = p_1 + p_2 + \cdots + p_n \to \infty$ as $n \to \infty$. A sequence $x = (x_k)$ is said to be weighted statistical convergent to the number λ if for every $\varepsilon > 0$,

$$\lim_{n\to\infty} \frac{1}{P_n} |\{k \epsilon P_n : p_k |x_k - \lambda| \geq \varepsilon\}| = 0$$

(Mursaleen,Karakaya, Ertürk and Gürsoy 2012). Recently, Ghosal (2004) modified this notion by adding the condition $\liminf_k p_k > 0$ for well defined.

Başarır and Konca have been defined a new concept of statistical convergence which is called weighted lacunary statistical convergence and obtained its relationship with the weighted statistical convergence and lacunary statistical convergence (Başarır and Konca 2014).

In this study, using the concept of weighted lacunary statistical convergence, a Korovkin type approximation theorem is proved. We ,show that our Korovkin type approximation theorem is stronger than its classical version. Moreover, the rate of weighted lacunary statistical convergence for operators in terms of modulus of continuity is computed.

Key Words: Weighted statistical convergence, lacunary statistical convergence, weighted lacunary statistical convergence, Korovkin type approximation theorem.

MSC : 40, 41.

REFERENCES

[1] H. Fast, Sur la convergence statistique, Colloq. Math. 2 (1951) 241-244.

[2] H. Steinhaus, Sur la convergence ordinate et la convergence asymptotique, Colloq. Math. 2 (1951) 73-74.

[3] J.A. Fridy, C. Orhan, Lacunary statistical convergence, Pacific J. Math. 160 (1993) 43-51

[4] F. Moricz, C. Orhan, Tauberian conditions under which statistical convergence follows from statistical summability by weighted means, Studia Sci. Math. Hungar. 41 (2004) 391-403.

[5] V. Karakaya, T.A. Chishti, Weighted statistical convergence, Iran. J. Sci. Technol. Trans. A. Sci. 33(2009) 219-223.

[6] M. Mursaleen, V. Karakaya, M. Ertürk, F. Gürsoy, Weighted statistical convergence and its application to Korovkin type approximation therem, Appl. Math. Comput. 218 (2012) 9132-9137.

[7] S. Ghosal, Generalized weighted random convergence in probability, Appl. Math. Comput. 249 (2014) 502-509.

[8] M. Başarır, Ş. Konca, On some spaces of lacunary convergent sequences derived by Nörlund-typr mean and weighted lacunary statistical convergence, Arab J. Math. Sci. 20 (2014) 250-263.

Shannon sampling theorem associated with discontinuous Sturm-Liouville problems

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ABSTRACT

Sturm-Liouville problems arise in modeling many processes appearing in different branches of natural science. In recent years there have been growing interest of new type Sturm-Liouville problems consisting of many-interval Sturm-Liouville equation under supplementary transmission conditions at the interior points of interaction. Such type of Sturm-Liouville problems arise after an application of the method of separation of variables to the varied assortment of physical problems, such as heat and mass transfer problems, diffractions problems, vibrating string problems when the string loaded additionally with point masses, the interaction of atomic particles, electrodynamics of complex medium, aerodynamics, eart's free oscillations and etc.

It is well-known that the Sampling theory is the main mathematical technique in communication engineering and information theory. In the recent years this theory find many applications in many branches of physics and engineering, such as signal analysis, meteorology, radar, medical imaging and etc. Moreover, this theory can be applied to any problems, where the solution need to be reconscructed from the values of the solution or their derivatives at certain sampled points.

Nowadays the Shannon's Sampling Theory has received considerable attention in the Sturm-Liouville theory. In the simple case when the Wiess-Kramer sampling theorem arises from a regular Sturm-Liouville eigenvalue problem, the corresponding sampling series is the Lagrange type interpolation series. The present work concerned with some spectral aspects of new type discontinuous Sturm-Liouville problems by using the sampling method. Particularly, we prove sampling

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theorem for integral transforms whose kernel is the Green's function of the problem under consideration.

Key Words: Sturm-Liouville problems, eigenvalue, Shannon's Sampling Theory.

MSC : 08, 65, 68.

REFERENCES

[1] A. I. Zayed, Advances in Shannon's Sampling Theory, CRC Press, Taylor&Francis Group, Boca Raton, 1993.

[2] A. Boumenir, B. Chanane, Eigenvalues of Sturm-Liouville systems using sampling theory, Appl. Anal. 62, 323-334 (1996).

[3] M. H. Annaby, J. Bustoz, M. E. H. Ismail, On sampling theory and basic Sturm-Liouville systems, Journal of Computational and Applied Mathematics, 206, 73-85 (2007).

[4] M. M. Tharwat, Discontinuous Sturm-Liouville problems and associated sampling theories, Abstract and Applied Analysis, Volume 2011, Article ID 610232 (2011), doi:10.1155/2011/610232.

Numerical solution of one boundary problem using finite difference method

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ABSTRACT

The finite difference approximations for unknown function and its derivatives are one of the simplest and of the oldest methods to solve differential equations. It was already known by L. Euler (1707-1783) ca. 1768, in ordinary differential equations and was probably extended to partial differentialequations by C. Runge (1856-1927) ca. 1908. The advent of finite difference method in numerical applications began in the early 1950s and their development was stimulated by the emergence of computers that offered a convenient framework for dealing with many problems appearing in physics, engineering and other branches of natural science.

Despite of their importance, little attention has been given to develop some efficient numerical technique of solving discontinuous initial and boundary value problems. In principle, the finite difference method and other related methods cannot be applied directly to solve the discontinuous problems.

This study is concerned with the discontinuous boundary value problems consisting of a second-order differential equation of the type $-y''+p(x)y=0,\, x\in[-1,0)\cup(0,1]$ with separate boundary conditions and supplementary transmission conditions of the type $y(-0)=\alpha\, y(+0)$ and $y'(-0)=\beta\, y'(+0)$. Using the finite difference method we solve some second order initial and boundary value problems with discontinuities.

A generalization of the finite difference method to discontinuous problem is discussed. The optained result is illustrated with a numerical example.

Key Words: Sturm-Liouville problems, transmission conditions, finite difference method.
MSC : 08, 65, 68.

REFERENCES

[1] A. Kaw and S. H. Garapati, Textbook Notes for the Parabolic Differential Equations, http://numericalmethods.eng.usf.edu, 2011.

[2] Abu-Zaid, I. T., and M. A. El-Gebeily. "A finite-difference method for the spectral approximation of a class of singular two-point boundary value problems." IMA Journal of Numerical Analysis14.4 (1994): 545-562.A. V. Likov, Yu. A. Mikhailov, The Theory of Heat and Mass Transfer, Translated from Russian by I. Shechtman, Israel Program for Scientific Translations, Jerusalem, 1965.

[3] E. A. Al-Said, M. A. Noor, and Th. M. Rassias, “Numerical solutions of third-order obstacle problems,”International Journal of Computer Mathematics, vol. 69, no. 1-2, pp. 75–84, 1998.

[4] E. A. Al-Said, “Numerical solutions for system of third-order boundary value problems,” International Journal of Computer Mathematics, vol. 78, no. 1, pp. 111–121, 2001.

[5] Li, Ronghua, Zhongying Chen, and Wei Wu. Generalized difference methods for differential equations: numerical analysis of finite volume methods. CRC Press, 2000.J. D. Pryce, Numerical solution of Sturm-Liouville Problems, Oxford University Press, 1993.

[6] Noor, M. Aslam, and E. A. Al-Said. "Finite-difference method for a system of third-order boundary-value problems." Journal of optimization theory and applications 112.3 (2002): 627-637.F. R. Lapwood, T. Usami; Free Oscillations of the Earth, Cambridge University Press, Cambridge, 1981.

Finite difference method for approximate solution of a boundary value problem with interior singular point

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ABSTRACT

Many problem of physics and engineering are modelled by boundary value problems for ordinary or partial differential equations. Usually, it is impossible to find the exact solution of the boundary value problems, so we have to apply various numerical methods.

There are different numerical methods (for example, the Explicit Euler method, the Runge-Kutta method, the Improved Euler method, Finite difference method and finite element method) for determining the approximate solutions of initial and boundary-value problems. One of them is the finite difference method, which is the simplest scheme. This method can be applied to higher of ordinary differential equations, provided it is possible to write an explicit expression for the highest order derivative and the system has a complete set of initial conditions.

In this study, we are interested in the finite difference method for new type boundary value problems. We describe the numerical solutions of some two-point boundary value problems by using finite difference method. This method are based upon the approximations that allow to replace the differential equations by algebraic system of equations and the unknowns solutions are related to grid points. In this article, we have presented a finite difference method for solving second order boundary value problems for ordinary differential equations with an internal singularity. This method tested on several model problems for the numerical solution.

Key Words: Boundary-value problems, boundary conditions, finite difference method.
MSC : 08, 65, 68.

REFERENCES

[1] P. K. Pandey Finite Difference Method for Numerical Solution of Two Point Boundary Value Problems with Non-uniform Mesh and Internal Boundary Condition, General Letter in Mathematics Vol.4 Feb 2018, pp.6-12

[2] G. Sebestyen, Numerical Solution of Two-Point Boundary Value Problems, B.S.c. Thesis, Department of Applied Analysis and Computational Mathematics Eotvos Lorand University Budapest, 2011

[3] Li, Zhilin, Zhonghua Qiao, and Tao Tang. Numerical solution of differential equations: introduction to finite difference and finite element methods. Cambridge University Press, 2017.

Some inequalities of Hermite-Hadamard type for differentiable of class Godunova-Levin functions via fractional integrals

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ABSTRACT

In optimization theory, convex analysis occupies a special place. Especially, for the last several decades, a lot of research has been devoted to issues of the theory of convexity (e.g. see [1] - [5] and references therein).

It is also known that in the convex analysis a very important place is occupied by the integral inequality of Hermite - Hadamard (see [6]).

For this reason, almost all studies are devoted to obtaining upper bounds for this inequality. Today in the literature there are a large number of classes of convex functions that are built on the basis of the classical convexity of a function. One of these classes is the Godunova-Levin function ([7]).

In this paper, we obtain new inequalities of Hermite – Hadamard type, associated with fractional integrals ([8]) for functions whose second derivatives, which are Godunov – Levin functions. These inequalities are obtained with the help of the Hölder and the power mean inequality.

The presented results were obtained on the basis of the lemma formulated by B. Bayraktar in work [6]:

Lemma. Let $f: I \subset \mathbb{R} \to \mathbb{R}$ be a twice differentiable mapping on I°. If $f'' \in L[a,b]$, where $a, b \in I$, then for all $\alpha > 1$ the following equality holds:

$$\frac{f(a)+f(b)}{2} - \frac{\Gamma(\alpha+1)}{2(b-a)^{\alpha-1}} \times U = \frac{(b-a)^2}{2}(I_1 + I_2)$$

Where

$$U = \frac{\alpha+1}{b-a}\left[J_{a^+}^{\alpha} f(b) + J_{b^-}^{\alpha} f(a)\right] - \left[J_{a^+}^{\alpha-1} f(b) + J_{b^-}^{\alpha-1} f(a)\right],$$

$$I_1 = \int_0^1 t(1-t)^{\alpha} f''(ta+(1-t)b)dt \text{ and } I_2 = \int_0^1 t(1-t)^{\alpha} f''(bt+(1-t)a)dt$$

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Key Words: convex function, Godunova-Levin function, s-Godunova-Levin function.

MSC : 26D15, 26D10, 26A51.

REFERENCES

[1] S. S. Dragomir, J. Peµcari´c and L. Persson, Some Inequalities of Hadamard Type. Soochow J. Math. 21 (3), (1995) 335-341.

[2] I. Işcan, Hermite-Hadamard type inequalities for harmonically (alpha;m)-convex functions,J. Hacettepe of Mathematics and Statistics 45(2) (2016) 381-390.

[3] A. O. Akdemira, M. E. Özdemir, S. Varošanec, On some inequalities for h-concave functions, Mathematical and Computer Modelling 55 (2012) 746–753

[4] M. A. Noor, K. I. Noor and F. Safdar, New inequalities for generalized Log h-convex functions, J. Appl. Math.& Informatics 36 (3,4) (2018) 245-256

[5] B. Bayraktar and V. Kudaev, Some new integral inequalities for (s;m)-convex and (α, m)-convex functions, Bulletin of the Karganda University-Mathematics, (Accepted 2019).

[6] J. Hadamard, Étude sur les propriétés des fonctions entières en particulier d'une function considérée par Riemann. J. Math. Pures Appl. 58 (1893) 171-215.

[7] E. K. Godunova and V. I. Levin: Inequalities for functions of a broad class that contains convex, monotone and some other forms of functions. (Russian) Numerical mathematics and mathematical physics (Russian), 166 (1985) 138-142, 166,

[8] Miller, S. and Ross, B. An introduction to the Fractional Calculus and Fractional Differential Equations. USA: John Wiley & Sons, p.2. 1993

Eigenvalue problems with interface conditions

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ABSTRACT

Sturm-Liouville type boundary value problems arise a result of using the Fourier's method of separation of variables to solve the classical partial differential equations of mathematical physics, such as the Laplace's equation, the heat equation and the wave equation. A large class of physical problems require the investigation of the Sturm–Liouville type problems with the eigen parameter in the boundary conditions. Also, many physical processes, such as the vibration of loaded strings, the interaction of atomic particles, electrodynamics of complex medium, aerodynamics, polymer rheology or the earth's free oscillations yields Sturm-Liouville eigenvalue problems(see, for example, [1,2,3,7]). On the other hand, the Strum-Liouville problems with transmission conditions (such conditions are known by various names including transmission conditions, interface conditions, jump conditions and discontinuous conditions) arise in problems of heat and mass transfer, various physical transfer problems [4], radio science [6], and geophysics [5].

In this work we shall investigate some spectral properties of a regular Sturm-Liouville problem on a finite interval with the transmission conditions at a point of interaction. We prove that the set of eigenfunctions for the problem under consideration forms a basis in the corresponding Hilbert space.

Key Words: Sturm-Liouville type boundary value problems, transmission conditions.

MSC : 08, 65, 68.

REFERENCES

[1] Q. Kong, H. Wu and A. Zettl, Geometric aspects of Sturm-Liouville problems, Preprint.

[2] J. D. Pryce, Numerical solution of Sturm-Liouville Problems, Oxford University Press, 1993.

[3] M. Rotenberg, Theory and application of Sturmian functions. Adv. Atomic. and Mol. Phys. 6(1970).

[4] A. V. Likov, Yu. A. Mikhailov, The Theory of Heat and Mass Transfer, Translated from Russian by I. Shechtman, Israel Program for Scientific Translations, Jerusalem, 1965.

[5] O. N. Litvinenko, V. I. Soshnikov, The Theory of Heteregenous Lines and their Applications in Radio Engineering (in Russian), Radio, Moscow, 1964.

[6] F. R. Lapwood, T. Usami; Free Oscillations of the Earth, Cambridge University Press, Cambridge, 1981.

[7] O. Sh Mukhtarov, H. Olğar, K. Aydemir, Resolvent Operator and Spectrum of New Type Boundary Value Problems. Filomat, 29(7) (2015), 1671-1680.

Factorizations of Lipschitz *p*-compact operators

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ABSTRACT

Since Farmer and Johnson [1] introduced the notion of Lipschitz *p*-summing operators and the notion of Lipschitz *p*-integral operators between metric spaces, several works have appeared with the aim of extending different classes of linear operators to the Lipschitz operator (see for instance [2-3]). Recently, Vargas et al. [4] introduced the notion of Lipschitz compact (weakly compact, finite-rank, approximable) operators from a pointed metric space into a Banach space. Also, Vargas et al. [4] stated Lipschitz versions of Schauder type theorems on the (weak) compactness of the adjoint of a (weakly) compact linear operators. Motivated by the well-know Grothendieck's characterization of compact sets [5], Sinha and Karn [6] introduced and studied *p*-compact sets and *p*-compact operators.

The *p*-compact sets and operators are also studied in the last years, not only in the linear case but also in the non-linear case. Achour et al. [7] introduced different notions of Lipschitz operators related with *p*-compact sets: the Lipschitz *p*-compact operators, the Lipschitz free-*p*-compact operators, and the locally *p*-compact Lipschitz operators.

The aim of this work is to obtain various factorizations of the Lipschitz *p*-compact operators between pointed metric spaces and Banach spaces. To do so, it will strongly be used the factorizations of *p*-compact linear operators.

Key Words: Lipschitz operators, Lipschitz *p*-compact operators, factorization.

MSC: 46, 47.

REFERENCES

[1] J.D. Farmer, W.B. Johnson, Lipschitz *p*-summing operators, Proc. Amer. Math. Soc. 137 (9) (2009) 2989-2995.

[2] J.A. Chávez-Domínguez, Duality for Lipschitz *p*-summing operators, J. Funct. Anal. 261 (2011) 387-407.

[3] D. Chen, B. Zheng, Lipschitz *p*-integral operators and Lipschitz *p*-nuclear operators, Nonlinear Anal. 75 (13) (2012) 5270-5282.

[4] A.J. Vargas, J.M. Sepulcre, M. Villegas-Vallecillos, Lipschitz compact operators, J. Math. Anal. Appl. 415 (2) (2014) 889-901.

[5] A. Grothendieck, Produits tensoriels topologiques et espaces nucléaries, Mem. Amer. Math. Soc. 16 (1955).

[6] D.P. Sinha, A.K. Karn, Compact operators whose adjoints factor through subspaces of l*p*, Studia Math. 150 (2002) 17-33.

[7] D. Achour, E. Dahia, P. Turco, Lipschitz *p*-compact mappings, Monatshefte für Mathematik, 2019.

A generalization of parabolic potentials associated to Laplace-Bessel differential operator

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ABSTRACT

Singular parabolic Riesz and parabolic Bessel type potentials are defined as negative fractional powers of the singular heat operators $(\frac{\partial}{\partial t} - \Delta_v)$ and $(E + \frac{\partial}{\partial t} - \Delta_v)$, respectively. Here, E is the identity operator and Δ_v is the Laplace-Bessel singular differential operator defined by

$$\Delta_v = \sum_{k=1}^{n} \frac{\partial^2}{\partial x_k^2} + \frac{2v}{x_n}\frac{\partial}{\partial x_n}, (v > 0\ is\ a\ fixed\ paremeter).$$

More precisely, these potentials are defined in terms of the Fourier-Bessel transform by

$$(H_v^\alpha f)^\wedge(x,t) = (|x|^2 + it)^{-\frac{\alpha}{2}} f^\wedge(x,t), \qquad (1)$$

and

$$(\mathcal{H}_v^\alpha f)^\wedge(x,t) = (1 + |x|^2 + it)^{-\frac{\alpha}{2}} f^\wedge(x,t), \qquad (2)$$

where $x \in \mathbb{R}_+^n = \{\xi | \xi = (\xi_1, \dots, \xi_{n-1}, \xi_n);\ \xi_n > 0\}, |x|^2 = x_1^2 + \cdots + x_n^2 ; t \in (-\infty, \infty)$ and the Fourier-Bessel transform

$$f^\wedge(x,t) = \int_{\mathbb{R}_+^n} f(y,t) e^{-ix'y'} J_{v-\frac{1}{2}}(x_n y_n) y_n^{2v}\, dy$$

is acted with respect to the y-variable.

Here, $x'y' = x_1y_1 + \cdots + x_{n-1}y_{n-1},\ dy = dy_1 \dots dy_n$ and $J_{v-\frac{1}{2}}(s)$ is the normalized Bessel function.

The singular parabolic potentials $H_v^\alpha f$ and $\mathcal{H}_v^\alpha f$, initially defined by (1) and (2), can be represented as integral operators

$$H_v^\alpha f\,(x,t) = \frac{1}{\Gamma\left(\frac{\alpha}{2}\right)} \int_{\mathbb{R}_+^n} \int_0^\infty \tau^{\frac{\alpha}{2}-1} W_v(y,\tau) T^{y,\tau} f(x,t) y_n^{2v} dy d\tau, \qquad (3)$$

and

$$\mathcal{H}_v^\alpha f\,(x,t)=\frac{1}{\Gamma\left(\frac{\alpha}{2}\right)}\int_{\mathbb{R}_+^n}\int_0^\infty \tau^{\frac{\alpha}{2}-1}e^{-\tau}W_v(y,\tau)T^{y,\tau}f(x,t)y_n^{2v}dyd\tau. \quad (4)$$

Here,

$$W_v(y,\tau)=c(n,v)(2\tau)^{-\frac{n+2v}{2}}\exp\left(-\frac{|y|^2}{4\tau}\right),(y\epsilon\mathbb{R}_+^n,\tau>0)$$

is generalized Gauss-Weierstrass kernel, $T^{y,\tau}$ is the generalized translation and

$$c(n,v)=\left[(2\pi)^n 2^{2v-1}\Gamma^2(v+\frac{1}{2})\right]^{-1},(see\ [1,2,3]).$$

In this work we introduce the operators

$$H_{\beta,v}^\alpha=\left(\frac{\partial}{\partial t}+(-\Delta_v)^{\beta/2}\right)^{-\alpha/\beta}\ and\ \mathcal{H}_{\beta,v}^\alpha=\left(E+\frac{\partial}{\partial t}+(-\Delta_v)^{\beta/2}\right)^{-\alpha/\beta},(\alpha,\beta>0),$$

Which have the following integral representations:

$$H_{\beta,v}^\alpha f\,(x,t)=\frac{1}{\Gamma\left(\frac{\alpha}{\beta}\right)}\int_{\mathbb{R}_+^n}\int_0^\infty \tau^{\frac{\alpha}{\beta}-1}W_v^{(\beta)}(y,\tau)T^{y,\tau}f(x,t)y_n^{2v}dyd\tau, \qquad (5)$$

and

$$\mathcal{H}_{\beta,v}^\alpha f\,(x,t)=\frac{1}{\Gamma\left(\frac{\alpha}{\beta}\right)}\int_{\mathbb{R}_+^n}\int_0^\infty \tau^{\frac{\alpha}{\beta}-1}e^{-\tau}W_v^{(\beta)}(y,\tau)T^{y,\tau}f(x,t)y_n^{2v}dyd\tau. \quad (6)$$

Here, the kernel function $W_v^{(\beta)}(y,\tau)$ is defined as inverse Fourier-Bessel transform of the function $\exp(-\tau|y|^\beta)$, i.e.

$$\left(W_v^{(\beta)}(y,\tau)\right)^\wedge(y,\tau)=e^{-\tau|y|^\beta},(0<\beta<\infty).$$

It is clear that in case of $\beta=2$ the integral operators (5) and (6) coincide with singular parabolic Riesz and parabolic Bessel potentials (3) and (4).

In this work we investigate the properties of the operators (5) and (6) in the framework of special weighted L_p-spaces, defined as

$$L_{p,v}=\{f\,|\,\|f\|_{p,v}\equiv\int_{\mathbb{R}_+^n}\int_0^\infty(|f(x,t)|^p x_n^{2v}dxdt)^{1/p}<\infty.$$

Key Words: Laplace-Bessel differential operator, Fourier-Bessel transform, parabolic potentials.

MSC: 47, 26

REFERENCES

[1] I. A. Aliev, B. Rubin, Parabolic potentials and wavelet transforms with the generalized translation, Studia Mathematica, 145(1) (2001), 1-16.

[2] I. A. Aliev, B. Rubin, S. Sezer, S. Uyhan, Composite wavelet transforms: applications and perspectives, Contemporary Mathematics, AMS, 464(2008), 1-27.

[3] S. Sezer, I. A. Aliev, On spaces of parabolic potentials associated with the singular heat operator, Turkish J. Math., (29) (2005), 299-314.

Generalized Fractional Integral Operators on Vanishing Generalized Local Morrey Spaces

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ABSTRACT

The purpose of the present paper is to study certain estimates related to the generalized fractional integral operator I_ρ which a generalization of Riesz potential operator (see [4]). It is well known that the Riesz potential and the Calderon-Zygmund operators play an important role in harmonic analysis (see [6]). Some boundedness of classical operators of harmonic analysis in Morrey-type spaces was proved in [1,4,5].

Wiener [7] looked for a way to describe the behavior of a function at the infinity. The conditions he considered are related to appropriate weighted Lq spaces. Beurling [3] extended this idea and defined a pair of dual Banach spaces. To be precise, Aq is a Banach algebra with respect to the convolution, expressed as a union of certain weighted Lebesgue Lq spaces; the dual Banach space is expressed as the intersection of the corresponding weighted dual Lebesgue Lq' spaces. Alvarez, Guzman-Partida and Lakey [2] in order to study the relationship between central Bounded Mean Oscillation (BMO) spaces and Morrey spaces, they introduced lamda-central bounded mean oscillation spaces and central Morrey spaces. Inspired by this, we consider the boundedness of fractional integral operator with rough kernel on generalized local Morrey spaces and give the central bounded mean oscillation estimates for their commutators.

In this study, the Spanne type boundedness of the generalized fractional integral operators I_ρ on the vanishing generalized local Morrey spaces $VLM^{\{x_0\}}_{p,\varphi}(R^n)$ and vanishing weak generalized local Morrey spaces $VWLM^{\{x_0\}}_{p,\varphi}(R^n)$ will be proved. Also the Adams type boundedness of the operators I_ρ on the vanishing generalized

Morrey spaces $VM_{p,\varphi}(R^n)$ and vanishing weak generalized Morrey spaces $VWM_{p,\varphi}(R^n)$ will be proved.

Key Words: Vanishing generalized local Morrey spaces, generalized fractional integral operators.

MSC : 42B20, 42B25, 42B35.

REFERENCES

[1] D.R. Adams, A note on Riesz potentials, Duke Math. 42, (1975), 765-778.

[2] J. Alvarez, M. Guzman-Partida, J. Lakey, Spaces of bounded lambda-central mean oscillation, Morrey spaces, and lambda-central Carleson measures, Collect. Math. 51, (2000), 1-47.

[3] A. Beurling, Construction and analysis of some convolution algebras, Ann. Inst. Fourier Grenoble) 14, (1964), 132.

[4] V.S. Guliyev, A.F. Ismayilova, A. Kucukaslan, A. Serbetci, Generalized fractional integral operators on generalized local Morrey spaces, Journal of Function Spaces, (2015), 1-20.

[5] N. Samko, Maximal, potential and singular operators in vanishing generalized Morrey spaces, J. Global Optim, (2014).

[6] E.M. Stein, Singular Integrals and Differentiability of Functions, Princeton Univ. Press, Princeton, NJ (1970).

[7] N. Wiener, Generalized Harmonic Analysis, Acta Math. (55), (1930), 117-258.

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Schur stability for delay difference equations

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ABSTRACT

Numerical characteristic $\omega(A)$ for Schur stability of the system of linear difference equations with constant coefficients matrix A is suggested in [1]. The algorithm with guaranteed accuracy for computing $\omega(A)$ one can find in [2]. There exists different ways to write difference equations with constant coefficients as a linear system. One of them uses a companion matrix (see, for example]2-4[). In the presentation the authors give some examples which show that this way is not optimal. The preferable systems are the systems with the symmetric matrices as coefficients. It is well-known that computing of the eigenvalues of a symmetric matrix is well-posed problem. The parameter $\omega(A)$ in this case is depends on the eigenvalues of A.

The question degree of delay of difference equations is not straightforward. So sometimes the delay leads equation to a stable one. At the same time, the degree to which the delay should be discussed is also the subject of discussion. It is proposed to solve this problem using the numerical stability parameter $\omega(A)$. All examples are computed using the softwares “Discrete Cauchy Solver” [5] and “Matrix Vector Calculator” [6].

Key Words: delay equations, schur stability, numerical characteristics.

MSC: 65F22

REFERENCES

[1] A.Ya. Bulgakov, S.K.Godunov, Circular dichotomy of the matrix spectrum. Sib. Math. J.29, n5, pp.59-70,1988.

[2] O. Akin, H. Bulgak Linear Dıfference Equations and Stability Theory, SelUn Vakfi, KONYA,1998 (in Turkish).

[3] H. Bereketoglu**,** V.Kutay, Difference Equations, Gazi Kitabevi , 2012. (in Turkish).

[4] S. Elaydi, An Introduction to Difference Equations. Undergraduate text in Mathematics, Springer, 2005

[5] A. Bulgak**, D**.Eminov, Cauchy Solver, Selcuk. J. Appl. Math.,v4, n2, pp.13-22, 2003.

[6] H. Bulgak**, D**.Eminov, Computer Dialogue System MVC, Selcuk. J. Appl. Math.,v2, n2, pp.17-38, 2001.

An inverse coefficient problem for a non-linear wave equation

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ABSTRACT

The non-linear wave equation is used to model many non-linear phenomena. Inverse problems for non-linear wave equations provide an important value for physical applications, but there are limited results in this area, [1, 2]. The inverse problems associated with the recovery of the coefficient for non-linear hyperbolic equations are also scarce ([3, 4]) and need more consideration for further studies.

In this talk, we consider an initial boundary value problem for a non-linear wave equation

$$u_{tt}(x,t) = u_{xx}(x,t) + a(t)g(u(x,t)) + f(x,t),$$

with the initial conditions

$$u(x,0) = \varphi(x), u_t(x,0) = \psi(x),$$

and non-local boundary conditions

$$u(0,t) = 0, u_x(0,t) = u_x(1,t),$$

in the domain $(x,t) \in \{0 \le \mathrm{x} \le 1, 0 \le \mathrm{t} \le \mathrm{T}\}$ for some fixed $\mathrm{T} > 0$.

Because of the presence of the non-linearity $g(u)$, this problem for the unknown function $u(x,t)$ is over-specified for arbitrary functions $f(x,t)$, $g(u(x,t))$, $\varphi(x)$, and $\psi(x)$. Thus there may exist no solution $u(x,t)$. In the case of $g(u) = u$, this equation is linear. The inverse coefficient/source problems for the linear hyperbolic equation with different boundary conditions were satisfactorily studied in various literature, see [5, 6, 7].

Our aim is to determine the time-dependent coefficient $a(t)$ multiplying non-linear term together with the wave displacement $u(x,t)$ by using an additional condition

$$u(1,t) = h(t), 0 < t < T,$$

and prove the existence and uniqueness theorem for small times. We also propose a numerical scheme (finite difference method) to solve the inverse problem for non-linear wave equation, and give test examples for sine, quadratic and cubic non-linearity.

Key Words: Non-linear hyperbolic equation, inverse coefficient problem, finite difference method.

MSC: 35R30, 35L70, 65M06

REFERENCES

[1] A.M. Denisov, Inverse problem for a semilinear functional-differential wave equation, Journal of Inverse and Ill-posed Problems, 16 (9) (2008) 837-848.

[2] J.R. Cannon, P. DuChateau, An inverse problem for an unknown source term in a wave equation, SIAM Journal on Applied Mathematics, 43 (3) (1983) 553-564.

[3] M. Slodicka, L. Seliga, Determination of a time-dependent convolution kernel in a non-linear hyperbolic equation, Inverse Problems in Science and Engineering, 24 (6) (2016) 1011-1029.

[4] I. Tekin, Y.T. Mehraliyev, M.I. Ismailov, Existence and uniqueness of an inverse problem for a nonlinear Klein-Gordon equation, Mathematical Methods in the Applied Sciences, (2019) doi: 10.1002/mma.5609

[5] G.K. Namazov, Inverse problems of the theory of equations of mathematical physics, Baku, Azerbaijan, 1984, (İn Russian).

[6] V.G. Romanov, Inverse problems of mathematical physics, VNU Science Press BV, Utrecht, Netherlands, 1987.

[7] S.O. Hussein, D. Lesnic, M. Yamamoto, Reconstruction of space-dependent potential and/or damping coefficients in the wave equation, Computers and Mathematics with Applications, 74 (6) (2017), 1435-1454.

Oscillation of partial difference equations compared with ordinary difference equations

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ABSTRACT

This is a survey talk in which we will be listing almost chronologically some of the most important results on oscillation and nonoscillation of ordinary difference equations of the form $u(m+1)-u(m)+\sum_{k=1}^{r}p_k(m)u(m-\tau_k)=0$, where r is a positive integer, p_k are sequences of nonnegative reals and τ_k are nonnegative integers, and partial difference equations of the form $u(m+1,n)+u(m,n+1)-u(m,n)+\sum_{k=1}^{r}p_k(m,n)u(m-\tau_k,n-\sigma_k)=0$, where r is a positive integer, p_k are double sequences of nonnegative reals and τ_k,σ_k are nonnegative integers. In the ordinary case, oscillation and nonoscillation results for equations with variable coefficients cover the criterion for autonomous equations. However, in the case of partial difference equations, oscillation and nonoscillation results for equations with variable coefficients do no reduce to the criterion for equations with constant coefficients. To fill this gap in the literature of partial difference equations, we will be establishing some connections between the results for oscillation and nonoscillation of ordinary difference equations and the results for oscillation and nonoscillation of partial difference equations to introduce new ideas for improving some of the results in the literature concerning the oscillation of partial difference equations with variable coefficients. We will be also presenting some comparative numerical examples with graphical demonstrations to illustrate the results in the literature and mention strengths and weakness of the new results.

Key Words: Oscillation, Ordinary Difference Equations, Partial Difference Equations.

MSC: 39A14, 39A21.

REFERENCES

[1] J. S. Yu, B. G. Zhang, and Z. C. Wang, Oscillation of Delay Difference Equations, Appl. Anal., 53 (1994), 117--124.

[2] I. Györi and G. Ladas, Oscillation Theory of Delay Differential Equations with Applications, Oxford University Press, New York, 1991.

[3] B. G. Zhang and Y. Zhou, Qualitative Analysis of Delay Partial Difference Equations, Hindawi Publishing Corporation, New York, 2007.

On the Riesz basisness of root functions of discontinuous boundary problem

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ABSTRACT

When studying specific classes of differential operators, it is often difficult to derive exact asymptotic formulas for the eigenvalues and eigenfunctions. Using these formulas, basisness of the root functions of the problems is proved. In [1, 2], it has been established that the system of root functions of a differential operator with strong regular boundary conditions forms Riesz basis in $L_2(0,1)$.In [2,3] it is shown that the root functions of a boundary problem which is generated by not strongly regular boundary conditions may not be form a basis in $L_2(0,1)$.

In this paper, we consider the non-selfadjoint discontiunios Sturm Liouville operator

$$l(y)=\begin{cases} l_1(y_1), & x\in(-1,0) \\ l_2(y_1), & x\in(0,1) \end{cases}$$

where

$$l_1(y_1)=y_1^{"}+q_1(x)y_1$$

$$l_2(y_2)=y_2^{"}+q_2(x)y_2$$

where $q_1(x)$ and $q_2(x)$ are complex valued functions and continuous on $[-1,0],[0,1]$.

We are interested in the problem of the operator under the boundary conditions

$$U_1(y):=U_{1,-1}(y_1)+U_{1,1}(y_2)=y_1(-1)-y_1(1)=0$$

$$U_2(y):=U_{2,-1}(y_1)+U_{2,1}(y_2)=y'_1(-1)-y'_2(1)=0$$

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and compatibility conditions

$$V_3(y) := V_{3,0}(y_1) + V_{3,0}(y_2) = y_1(-0) - y_1(+0) = 0$$

$$V_4(y) := V_{4,0}(y_1) + V_{3,0}(y_2) = y'_1(-0) - y'_1(+0) = 0$$

with periodic boundary condition and compatibility conditions.

Asymptotic formulas of eigenvalues and eigenfunctions of the operator are obtained. Using these asymptotic formulas for eigenvalues and eigenfunctions we prove the basisness of the root functions of the boundary value problem. Different kind of boundary and compatible conditions of this problem is also considered.

Key Words: Sturm Louville Problem, Riesz Basis, Discontinuous Boundary Condition.

REFERENCES

[1] V P Mikhailov. On the bases in L2(0,1). Dokl. Akad. Nauk SSSR [Soviet Math. Dokl.], 144(5) (1962), 981-984.

[2] G M Kesel'man. On the unconditional convergence of expansions in the eigenfunctions of some differential operators, Izv. Vyssh. Uchebn. Zaved. Mat. [Soviet Math.(Iz.VUZ)],2 (1962), 82-93.

[3] Makin AS. Convergence of expansions in the root functions of periodic boundary value problems. Doklady Math. 73(1) (2006), 71-76.

[4] Muravei LA. Riesz bases in L2(-1,1). Proceedings of the Steklov Institute of Mathematics 91 (1967)113–131.

[5] Mamedov KR. On the Basis Property in Lp (0,1) of the Root Functions of a Class Non Self Adjoint Sturm-Lioville Operators. European Journal of Pure and Applied Math. 3(5) (2010), 881-838.

The principal eigenvalue and the principal eigenfunction of a boundary-value-transmission problem

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ABSTRACT

It is the theory behind Sturm-Liouville problems that, ultimately, justifies the “separation of variables”n method for these partial differential equation problems. For Sturm-Liouville problems The Rayleigh quotient is the basis of an important approximation method that is used in solid mechanics as well as in quantum mechanics. Although any eigenvalue can be related to its eigenfunction by the Rayleigh quotient, this quotient cannot be used to explicitly determine the eigenvalue since eigenfunction is unknown. However, interesting and significant results can be obtained from the Rayleigh quotient without solving the differential equation(i.e. even in the case when the eigenfunction is not known). For example, it can be quite useful in estimating the eigenvalue. It is the purpose of this paper to extend and generalize such important spectral properties as Rayleigh quotient, eigenfunction expansion, Parseval equality and Rayleigh-Ritz formula(minimization principle) for Sturm-Liouville problems with interior singularities. In this paper we shall investigate certain spectral problems arising in the theory of the convergence of the eigenfunction expansion for one nonclassical eigenvalue problem. By modifying the Green’s function method we shall extend and generalize such important spectral properties Rayleigh quotient and Rayleigh-Ritz formula for the new type Sturm-Liouville problems.

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Key Words: Boundary-value problem, Rayleigh quotient.

MSC : 34, 46.

REFERENCES

[1] B.M. Levitan, Eigenfunction in Characteristic Functions of Differential Equations of the Second Order, Gosudarstv. Izdat. Tehn.-Teor. Lit., Moscow-Leningrad, 1950.

[2] F.S. Muhtarov, K. Aydemir, Distributions of eigenvalues for Sturm-Liouville problem under jump conditions, Journal of New Results in Science, 1 (2012) 81-89.

[3] O.Sh. Mukhtarov, S. Yakubov, Problems for differential equations with transmission conditions, Applicable Anal. 81 (2002) 1033-1064.

[4] E.C. Titchmarsh, Eigenfunctions Expansion Associated with Second Order Differential Equations I, 2nd ed. Oxford Univ. Press, London, 1962.

Equiconvergence with Fourier series for non-classical Sturm–Liouville problems

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ABSTRACT

Sturm–Liouville type boundary-value problems arise in many engineering and scientific disciplines as the mathematical modeling of systems and processes in the fields of chemistry, aerodynamics, electrodynamics of complex medium or polymer rheology. For example the vibration of a homogeneous loaded strings, the earth's free oscillations, the interaction of atomic particles, sound, surface waves, heat transfer in a rod with heat capacity concentrated at the ends electromagnetic waves and gravitational waves can be solved using the Sturmian theory. A large class of physical problems require the investigation of the Sturm–Liouville type problems with discontinuous. Examples are vibration problems under various loads such as a vibrating string with a tip mass or heat conduction through a liquid solid interface. In this study we shall investigate some properties of the eigenfunctions of one discontinuous Sturm–Liouville Problems. We shall prove some preliminary results related to the basic solutions, Green's function, resolvent operator and selfadjointness of the considered problem. Particularly we shall present a new approach for constructing the Green's functions which is not standard one generally found in textbooks. The obtained results are implemented to the investigation of the basis properties of the system of eigenfunctions in modified Hilbert spaces. Finally, we shall show that the eigenfunction expansion series regarding the convergence behaves in the same way as an ordinary Fourier series.

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Key Words: Discontinuous Sturm–Liouville Problems, Green-function, jump conditions.

MSC : 34,46.

REFERENCES

[1] K. Aydemir and O. Sh. Mukhtarov, Green's Function Method for Self-Adjoint Realization of Boundary-Value Problems with Interior Singularities, Abstract and Applied Analysis Article ID 503267, 7 pages (2013), doi:10.1155/2013/503267..

[2] O.Sh. Mukhtarov and K. Aydemir, Eigenfunction Expansion for Sturm-Liouville Problems with Transmission Conditions at One Interior Point, Acta Mathematica Scientia 35B(3), (2015) 1–11.

[3] M. Rotenberg, Theory and application of Sturmian functions. Adv. Atomic. and Mol. Phys. 6(1970).E.C. Titchmarsh, Eigenfunctions Expansion Associated with Second Order Differential Equations I, 2nd ed. Oxford Univ. Press, London, 1962.

[4] S.Y. Yakubov and Y.Y. Yakubov, Differantial Operator Equations Ordinary and Partial Differential Equations, Chapman and Hall/CRC, Boca Raton, 2000.

Integral equation method for the modified Helmholtz equation with generalized impedance boundary condition

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ABSTRACT

We present a numerical solution method to the interior boundary value problem for the modified Helmholtz equation in two dimensions with a second order impedance boundary condition, the so-called generalized impedance boundary condition (GIBC). This problem arises in physics, chemistry and engineering science such as heat conduction etc, [1]. GIBCs are used to model solids coated with a thin layer of a penetrable material or corrugated surfaces and they are also used to simplify the analytical solutions or to reduce the cost of numerical solutions for problems involving complex structures. Mathematically, the problem reads as follows: given a bounded simply connected domain $D \subset R^2$ with a smooth boundary ∂D, a multiple of the convective heat transfer coefficient k^2 and positive differentiable impedance functions λ, μ find a solution to the boundary value problem

$$\Delta u - k^2 u = 0 \text{ in } D,$$
$$\frac{\partial u}{\partial \nu} + k\left(\lambda u - \frac{d}{ds}\mu\frac{du}{ds}\right) = g \text{ on } \partial D.$$

Employing the indirect approach, the boundary value problem is reduced to the boundary integral equation

$$\left(K' + \frac{I}{2} + k\left(\lambda - \frac{d}{ds}\mu\frac{d}{ds}\right)S\right)\phi = g \text{ on } \partial D$$

in terms of a single-layer operator S and its normal derivative operator K'. Following the ideas for a hypersingular integral equation in scattering theory, [3], we analyse properties of the integral operators in Sobolev spaces and prove the unique solvability of the obtained boundary integral equation by employing the Riesz theory, [3]. The integral equation is then solved by the collocation method with the integral operators approximated by quadrature rules based on trigonometric interpolation.

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Extending the results of [2], we have shown that in the case of analytic boundary and data g the numerical solution converges super-algebraically fast to the exact solution. The feasibility of the method is exhibited by numerical examples.

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Key Words: Integral equations method, modified Helmholtz equation, generalized impedance condition

MSC : 65R20, 65D30, 47G20, 45E05

REFERENCES

[1] Aziz, T. Fang, Thermal analysis of an annular fin with (a) simultaneously imposed base temperature and base heat flux and (b) fixed base and tip temperatures, Energy conversion and management 52 (7) (2011) 2467–2478.

[2] A. Kirsch and S. Ritter, The Nyström method for solving a class of singular integral equations and applications in 3D-plate elasticity, Mathematical methods in the applied sciences, Wiley online library,1999.

[3] R. Kress, On the numerical solution of a hypersingular integral equation in scattering theory, Journal of computational and applied mathematics 61 (3) (1995) 345–360.

[4] R. Kress, Linear integral equations, Springer, New York, 2014

The method of finding the square of the number with a known number of squares

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ABSTRACT

With the presence of the mankind, in a lot of science branches, a lot of theorems are set forth to enhance the development of science. Mathematics constitutes the basics of the science branches used by the mankind such as applied sciences, medicine, astronomy, philosophy, and etc. Mathematics is continuously developed by the scientists which is an integral part of our daily life in all occasions and finds its place in our daily life. One of the important subjects taking place in the mathematical environment is the method of finding the squares of numbers. As the digits of the numbers increase, finding the squares of the numbers become harder and more time consuming. A lot of research is being done for determining the square of numbers with more practical methods.

In this study, the theory of the method and its practical applications is explained for finding the square of a number with the help of a number which we know the square.

In our developed formula, A, B c, k being integers to show that if A^2=k, then the square of B (B^2=?) has to be determined by A more practical method. For the cases of B integer being greater than A integer (B>A) or smaller than A integer (B<A), the mathematically established relation of the known integer helps to determine the square of the unknown integer by our practical method.

As a result, a new method is gifted to the mathematical world besides the known methods of finding integer squares. with the help of this method, the square of an unknown integer is determined by the help of an integer whose square is known very practically.

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The necessary public notary registration and approval for theorem approval has been completed and the theorem has been gifted to the mathematical science environment as a new theorem.

Key Words: Teaching methods, methods of finding squares

MSC : 97D40

REFERENCES

[1] A. Kökçü, On the Nature and Meaning of Number, Beytulhikme An International Journal of Philosophy, Phil 8 (1) 2018, Research Article: 61-77.

[2] Y. Kara, S.A. Özgün-Koca, The Application of Discovery Learning and Meaningful Learning Approaches in Mathematics Classes: Two Lesson Plans on ”The Square of Addition of Two Terms”, Primary Education-Online Journal (http:/ / ilkogretim-online.org.tr) 3 (1), (2004)n2-10.

[3] P.S. Wilson and J.B. Chauvot, Who? How? What? A Strategy for Using History to Teach Mathematics 93 (8) (2000) 642-645.

[4] D. Flannery, The Square Root of 2 A Dialogue Concerning a Number and a Sequence, New York: Copernicus Books 2006.

[5] F. Karakuş, Using History of Mathematics in Mathematics Teaching: Babylonian Square Root Method, Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education Vol. 3 (2009) 195-206.

[6] Determination Report, Konya (Turkey) 7 th Notary, Operation Number: (A), 26 March 2008.

[7] Certificate of Registration, Republic of Turkey Ministry of Culture and Tourism, Certificate Number: 2018/867, Certificate Date: 19 October 2018.

Early warning signals of oxygen-plankton dynamics: mathematical approach

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ABSTRACT

Any significant decrease in the net oxygen production by phytoplankton is likely to result in the depletion of atmospheric oxygen and in global mass mortality of living beings due to more than half of the atmospheric oxygen is produced by marine phytoplankton. The rate of oxygen production is known to depend on water temperature and hence can be affected by global warming. In this work, it is assumed that oxygen production varies with time under the effect of increasing temperature. We address this ecological problem theoretically by a couple of plankton-oxygen dynamics. A nonlinear mathematical model is considered to investigate the effect of temperature on oxygen-plankton dynamics. The model is analyzed both analytical and numerical techniques, focusing on the existence and the nature of steady states of the system. From the analysis of the model, it has been observed that as temperature level goes above the critical threshold of oxygen production then the equilibrium density of plankton population decrease due to a decrease in oxygen concentration. It is also shown that the system dynamics may exhibit long-term sustainable dynamics that can still result in an ecological disaster, i.e., oxygen depletion and plankton extinctions. But in this case, extinction happens after a considerable period of time.

Key Words: Global warming, differential equation, extinction, oxygen depletion.

MSC: 65, 68.

REFERENCES

[1] Sekerci, Y., & Petrovskii, S. Mathematical modelling of plankton–oxygen dynamics under climate change. Bulletin of mathematical biology, 77(12) (2015) 2325-2353.

[2] Petrovskii, S., Sekerci, Y., & Venturino, E. Regime shifts and ecological catastrophes in a model of plankton-oxygen dynamics under the climate change. Journal of theoretical biology, 424 (2017) 91-109.

Environmental change effect on oxygen-plankton system: mathematical approach

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ABSTRACT

Oxygen depletion in a water body is a severe ecological problem, often being responsible for the extinction of marine fauna. Therefore, oxygen production by marine phytoplankton photosynthesis is thought to hold the key to the underlying structure of oxygen dynamics in the marine ecosystem. However, the oxygen concentration is not only determined by primary production. Its' concentration also depends on its consumption such as biochemical reaction in the water body, consumption by marine animals, water-air reaeration, etc. Plankton respiration is one of the these factors that play an important role in water body oxygen concentration. Therefore, in this talk, this issue is addressed theoretically by considering the oxygen-phytoplankton-zooplankton model to make an insight into system dynamics under the effect of changing environmental condition. A nonlinear mathematical model is considered to investigate the effect of temperature on oxygen-plankton dynamics with Holling Type II respiration for the consumption of water oxygen concentration. The model is analyzed both analytical and numerical calculations, focusing on the existence and behavior of systems' steady state. Moreover, it is noticed from the simulation, oxygen depletion can arise if the temperature exceeds a certain critical level. Interestingly, in a certain parameter range, our model shows the formation of spatial patterns that are qualitatively the same to those observed in field observations.

Key Words: Differential equation, oxygen consumption, respiration.

MSC: 65, 68.

REFERENCES

[1] Harris, G. Phytoplankton ecology: structure, function and fluctuation. Springer Science & Business Medi 2012.

[2] Jin, Z., Charlock, T. P., Smith Jr, W. L., & Rutledge, K. A parameterization of ocean surface albedo. Geophysical research letters, 31(22) (2004).

[3] Petrovskii, S., Sekerci, Y., & Venturino, E. Regime shifts and ecological catastrophes in a model of plankton-oxygen dynamics under the climate change. Journal of theoretical biology, 424 (2017) 91-109.

[4] Sekerci, Y., & Petrovskii, S. Mathematical modelling of plankton–oxygen dynamics under the climate change. Bulletin of mathematical biology, 77(12) (2015) 2325-2353.

Some characteristics of one periodic Sturm-Liouville problem

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ABSTRACT

Some of the problems of physics and mathematics include boundary conditions, partial derivative by time. Examples of heat and mass transmission problems, fixed two ends and vibration problems of the wire hanging on some internal points, some wave and diffusion problems can be given as examples. In some well-known works, it is investigated that spectral problems have spectral parameters not only in differential equations but also in boundary conditions.Therefore, boundary value problems which contain spectral parameters are very important in theory and practice.

In Mathematics and its application a classical Sturm-Liouville Equation named after the two Mathematicians Sturm (1803-1855) and Liouville (1809-1883), on an interval I, is a real second order differential equation of the form:

$$\frac{d}{dx}\left(p(x)\frac{dy}{dx}\right) + (q(x)+\lambda r(x))\, y(x) = 0,$$

for all x in the interval. p, q, r are real valued functions of x, λ is a parameter and the interval I may be closed, open, semi finite or infinite. The function r is called weight function. The Sturm-Liouville equation,

$$\frac{d}{dx}\left(p(x)\frac{dy}{dx}\right) + (q(x) + \lambda\, r(x))\, y(x) = 0 \quad \text{on} \quad a \le x \le b$$

in which $p(a) = p(b)$, together with the boundary conditions

$$y(a) = y(b) \text{ and } y'(a) = y'(b)$$

is called periodic Sturm-Liouville boundary value problem.

In this study, we examine a new singular eigenvalue problem, which consists of the differential equation

$$-y'' + q(x)\, y = \lambda\, y \quad \text{on} \quad x \in [a, c) \cup (c, b]$$

together with periodic boundary at the end-points x = a, b given by

$$y(a) = y(b) \ \text{ and } \ y'(a) = y'(b)$$

and the interface conditions at the points of singularity x=c given by

$$y(c+) = \alpha y(c-) \ \text{ and } \ y'(c+) = \beta y'(c-)$$

where q(x) is the continuous functions α, β are real number and λ is the complex eigenvalue parameter.

Key Words: Periodic Sturm-Liouville Problem, transmission conditions.

MSC : 34, 46.

REFERENCES

[1] M. Kandemir**,** O. Sh. Mukhtarov, Solvability of fourth order Sturm -Liouville problems with abstract linear functionals in boundary-transmission conditions, DOI: 10.1002/mma.4852, Math Meth Appl Sci. (2018) 1–10.

[2] O. Sh. Mukhtarov and K. Aydemir**,** Eigenfunction expansion for Sturm-Liouville problems with transmission conditions at one interior point, Acta Mathematica Scientia (2015) 35B(3):639–649.

[3] W.A. Woldegerima, The Sturm-Liouville Boundary Value Problems and their applications: First Edition, LAP Lambert Academic Publishing. 2011.

[4] L. Schovanec, D. Gilliam , Chapter 5. Sturm-Liouville Theory Mathematics and Statistics Texas Tech University 1998-1999.

New exact solutions of (3+1)-dimensional modified quantum Zakharov-Kuznetsov equation

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ABSTRACT

In this work, Generalized Kudryashov method (GKM) has been used to obtain exact solutions of (3+1)-dimensional modified quantum Zakharov-Kuznetsov (MQZK) equation. Dark optical soliton solutions of this equation have been found by using this method. Also, the graphical demonstrations clearly display strongness of this method.

Nonlinear partial differential equations (NLPDEs) are mostly utilized to clarify great numbers of physical facts in the fields such as quantum field theory, biology, hydrodynamics, meteorology, optical fibers.

Recently, many scientists have developed several methods to obtain exact solutions of NLPDEs such as generalized (G'/G) method [1], Hirota bilinear method [2], generalized simplest equation method [3], extended trial equation method [4], and so on. In this study, GKM [5,6] will be implemented to reach exact solutions of (3+1)-dimensional MQZK equation.

We submit (3+1)-dimensional modified QZK equation [7]

$$w_t + pw_x w^3 + qw_{zzz} + rw_{xxz} + sw_{yyz} = 0, \tag{1}$$

where p, q, r and s are real-valued constants. Here, the behaviour of the weakly nonlinear ion acoustic waves in the structure of an uniform magnetic field is controlled by the QZK equation [8].

In present work, we intend to find exact solutions of (3+1)-dimensional MQZK equation. Thereinafter, we give basic facts of GKM. Lastly, as an application, we obtain exact solutions of (3+1)-dimensional MQZK equation via GKM.

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Key Words: (3+1)-dimensional modified quantum Zakharov-Kuznetsov equation, Generalized Kudryashov method (GKM), dark optical soliton solution.

MSC: 35,68.

REFERENCES

[1] M. Foroutan, J. Manafian, A. Ranjbaran, Solitons in optical metamaterials with anti-cubic law of nonlinearity by generalized G'/G-expansion method, Optik, Vol:162 (2018) 86–94.

[2] D. Zuo, G. Zhang, Exact solutions of the nonlocal Hirota equations, Applied Mathematics Letters, Vol:93 (2019) 66–71.

[3] N.A. Kudryashov, Exact solutions of the equation for surface waves in a convecting fluid, Applied Mathematics and Computation, Vol:344–345 (2019) 97–106.

[4] S. T. Demiray, H. Bulut, New exact solutions for generalized Gardner equation, Kuwait Journal of Science, Vol:44 (2017) No:1, 1–8.

[5] S. T. Demiray, H. Bulut, Soliton solutions of some nonlinear evolution problems by GKM, Neural Computing and Applications, Vol:31 (2019) 287–294.

[6] S. T. Demiray, H. Bulut, New soliton solutions of Davey–Stewartson equation with power-law nonlinearity, Optical Quantum and Electronics, Vol:49, No:117 (2017) 1–8.

[7] R.I. Nuruddeen, K.K. Ali, K.S. Aboodh, Analytical Investigation Of Soliton Solutions To Three Quantum Zakharov-Kuznetsov Equations, Communications in Theoretical Physics 70 (2018) 405–412.

[8] M. S. Osman, Multi-soliton rational solutions for quantum Zakharov-Kuznetsov equation in quantum magnetoplasmas, Waves in Random and Complex Media, 26:4 (2016) 434-443.

Dark-bright optical soliton solutions of (3+1)-dimensional modified quantum Zakharov-Kuznetsov equation

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ABSTRACT

In this paper, the modified $\exp(-\vartheta(\sigma))$-expansion function method (MEFM) has been used to find exact solutions of (3+1)-dimensional modified quantum Zakharov-Kuznetsov (MQZK) equation. Dark and dark-bright optical soliton solutions of the (3+1)-dimensional MQZK equation have been obtained by using this method. Also, the graphical simulations explicitly exhibit forcefulness of this method.

Nonlinear evolution equations (NLEEs) are commonly utilized to interpret a lot of physical events in the fields such as quantum field theory, biology, hydrodynamics, meteorology, optical fibers.

Latterly, many researchers have established to obtain exact solutions of NLEEs a lot of methods such as KP hierarchy reduction and Hirota bilinear method [1], modified sub-equation extended method [2], trial equation method [3], Sine–Gordon expansion method [4], the new extended direct algebraic method [5]. Herein, MEFM [6] will be used to find new exact solutions of (3+1)-dimensional MQZK equation.

We investigate (3+1)-dimensional MQZK equation [7],

$$s_t + ps_x s^3 + qs_{zzz} + rs_{xxz} + \ell s_{yyz} = 0, \tag{1}$$

where $p, q, r,$ and ℓ are real-valued constants. Here, the behaviour of the weakly nonlinear ion acoustic waves in the structure of an uniform magnetic field is controlled by the QZK equation [8].

Herein, our aim is to get new exact solutions of (3+1)-dimensional MQZK equation via proposed method. In Sec. 2, we explain methodology. In Sec. 3, we perform proposed method to (3+1)-dimensional MQZK equation.

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Key Words: (3+1)-dimensional modified quantum Zakharov-Kuznetsov equation; MEFM; dark optical soliton solutions; dark-bright optical soliton solution; Mathematica.

MSC: 35,68.

REFERENCES

[1] J. Rao, D. Mihalache, Y. Cheng, J. He, Lump-soliton solutions to the Fokas system, Letters A, Vol:383 (2019) 1138–1142.

[2] H. Yépez-Martínez, H. Rezazadeh, A. Souleymanou, S. Paulin, T. Mukam, M.Eslami, V. Kamgang Kuetche, A. Bekir, The extended modified method applied to optical solitons solutions in birefringent fibers with weak nonlocal nonlinearity and four wave mixing, Chinese Journal of Physics, Vol:58 (2019) 137–150.

[3] A. Ozyapici, B. Bilgehan, Generalized system of trial equation methods and their applications to biological systems, Applied Mathematics and Computation, Vol:338 (2018) 722–732,

[4] D. Kumar, K. Hosseini, F. Samadani, H. Rezazadeh, The sine-Gordon expansion method to look for the traveling wave solutions of the Tzitzéica type equations in nonlinear optics, Optik, Vol:149 (2017) 439–446.

[5] H. Rezazadeh, New solitons solutions of the complex Ginzburg-Landau equation with Kerr law nonlinearity, Optik, Vol:167 (2018) 218–227.

[6] S. T. Demiray, H. Bulut, Analytical Solutions of Phi-four equations, An International Journal of Optimization and Control: Theories & Applications, Vol:7, No:3 (2017) 275–280.

[7] R. I. Nuruddeen, K. S. Aboodh, K. K. Ali, Analytical Investigation Of Soliton Solutions to Three Quantum Zakharov-Kuznetsov Equations, Communications in Theoretical Physics 70 (2018) 405-412.

[8] M. S. Osman, Multi-soliton rational solutions for quantum Zakharov-Kuznetsov equation in quantum magnetoplasmas, Waves in Random and Complex Media, 26:4 (2016) 434-443.

Mathematical analysis of the spread of SIQR model with Caputo fractional order derivative

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ABSTRACT

Fractional calculus is a very efficient way for researchers while studying real world phenomena problems like astronomy, biology, physics also in the social sciences e.g. education, history, sociology, life sciences . In recent years, fractional order differential equations have become an important tool in mathematical modelling. The most useful way to work on fractional modelling is considering models as a generalization of the integer order version. The most commonly used definitions are Riemann-Liouville and Caputo fractional derivative. The Riemann-Liouville derivative is historically the first but there are some difficulties while applying it to real life problems. In order to overcome these difficulties, the latter concept, fractional order Caputo type derivative is defined. The main advantage of Caputo's definition is that the initial conditions for fractional differential equations with Caputo derivatives take on the same form as for integer-order differential equations.

In this paper, we have investigated the basic theory of fractional differential equations involving fractional derivatives. Some disease models which are an important area in mathematical modelling are discussed [7]. But especially we are interested in investigating the spread of fractional order SIQR model using the concept of fractional operator of Caputo differentiations. After considered SIQR model with Caputo type, disease free equilibrium and endemic equilibrium points are computed. Also we have applied the next generation matrix method to calculated the basic reproduction number R0. The stability analysis of SIQR model and the existence and uniqueness of its solutions have been obtained. Finally a suitable iteration for the solutions of the SIQR model is obtained by Atangana-Toufik method.

Key Words: Fractional order differential equations, SIQR model, stability, existence and uniqueness.

MSC : 37Mxx, 93D20, 26A33.

REFERENCES

[1] Liu, Q., Jiang, D., & Shi, N. (2018). Threshold behavior in a stochastic SIQR epidemic model with standard incidence and regime switching. Applied Mathematics and Computation, 316, 310-325.S.G. Gal, Shape-Preserving Approximation by Real and Complex Polynomials, Birkhäuser Boston, Inc., Boston, MA, 2008.

[2] Podlubny, I.. Fractional differential equations: an introduction to fractional derivatives, fractional differential equations, to methods of their solution and some of their applications. Vol. 198. Elsevier, 1998.

[3] Toufik, M., & Atangana, A. New numerical approximation of fractional derivative with non-local and non-singular kernel: Application to chaotic models. The European Physical Journal Plus, 132(10) (2017) 444.

[4] Linda J.S. Allen, "An Introduction to mathematical biology," Pearson/Prentice Hall, 2007.

[5] Debnath, L. (2003). Recent applications of fractional calculus to science and engineering. International Journal of Mathematics and Mathematical Sciences, 54 (2003) 3413-3442.

[6] Diethelm, Kai. The analysis of fractional differential equations: An application-oriented exposition using differential operators of Caputo type. Springer Science & Business Media, 2010.

[7] Akpınar, Haldun. "Bulaşıcı hastalıkların yayılımının tahmininde deterministik modellerin kullanılması." 2012.

A possibility programming approach for integrated supply chain network design with distributed generation

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ABSTRACT

Production-distribution companies (such as electrical power systems and supply chain networks) intended to supply commodity to their customers in an economical and reliable manner. But, customers in most production-distribution companies are outspread and connected to the distribution networks with different types of material handling equipment. These equipments usually have various types and resistances together, that produce the highest loss and lowest reliability for distribution systems and customers. Usually, distributed generations (DGs) are one of the best reliable techniques to tackle these problems. In recent years, great attention has been paid to applying DG throughout electric distribution systems. Consequently, DGs are increased under the effect of various policies, such as distribution loss reduction, and increase system reliability, when they are located appropriately in the production-distribution networks.

The dynamic nature of the networks forces a high degree of uncertainty in many of distribution networks. A common method to model uncertainty in many problems is stochastic programming. For solving stochastic programming models, the size of model usually increases with respect to the number of scenarios; this matter causes computational challenges, so finding the best solution, particularly in large-scale networks, becomes more complicated. Robust optimization is another approach to deal with uncertainty. This approach assumes a deterministic uncertainty set, rather than a probability distribution, and attempts to find a solution, which is robust against all possible scenarios.

Recently, Khodayifar and et al. considered the integrated supply chain network design with distributed generation in certainty environment and solved their proposed model by using an accelerating Benders' decomposition approach [1]. In this paper,

we consider the integrated supply chain network design with distributed generation in uncertainty environment. For this problem, a possibilistic mixed integer-programming model proposed and solve the proposed possibilistic optimization model by fuzzy mathematical programming approaches [2].

Key Words: Supply chain, Possibilistic programming, Fuzzy mathematical programming.

MSC : 90C11, 90C06, 90C30, 90C27.

REFERENCES

[1] S. Rebennack, P.M. Pardalos, M.V Pereira, N.A Iliadis, Handbook of Power Systems I. Springer, Berlin 2010.

[2] S. Khodayifar, M. A. Raayatpanah, and P. M. Pardalos, An accelerating Benders' decomposition approach to the integrated supply chain network design with distributed generation, Energy Systems 9 (3) (2018) 647-667.

[3] M. Inuiguchi, and R. Jaroslav, Possibilistic linear programming: a brief review of fuzzy mathematical programming and a comparison with stochastic programming in portfolio selection problem, Fuzzy sets and systems 111 (1) (2000) 3-28.

Dynamical behaviour of fractional order tumor model with Caputo and conformable fractional derivative

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ABSTRACT

Research on fractional calculus has gained much interest over the past decades and fractional order differential equations has been well applied to many research fields. Fractional differential equations are also widely used to model biological phenomenon and there are successful applications in this field. Fractional order derivatives involve memory, and which is quite favourable to work on biological processes.

Trying to generalize notion of differentiation to arbitrary order brings out several approaches. The most knowns are Riemann-Liouville, Caputo and Grünwald-Letnikov definitions. Lately, a new definition called "conformable fractional derivative" has been introduced by Khalil et al. in 2014.

In this paper, tumor-immune system interaction has been considered by two fractional order models. The first and the second model consist of system of fractional order differential equations with Caputo and conformable fractional derivative respectively. Then, a discretization process is applied to obtain a discrete version of the second model where conformable fractional derivative is taken into account. In discrete model, we analyse the stability of the equilibrium points and prove the existence of Neimark-Sacker bifurcation depending on the parameter describing source rate of immune cells. The dynamical behaviours of the models are compared with each other and numerical simulations are also presented to illustrate the analytical results.

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Key Words: Tumor-immune interaction, conformable fractional derivative, piecewise-constant arguments

MSC: 37, 92.

REFERENCES

[1] I. Podlubny, Fractional Differential Equations, Academic Press New York, 1999.

[2] R. Khalil, M.A. Horani, A. Yousef, M. Sababheh, A new definition of fractional derivative, J. Comput. Appl. Math. 264 (2014) 65-70.

[3] E. Balcı, İ. Öztürk, Ş. Kartal, Dynamical behaviour of fractional order tumor model with Caputo and conformable fractional derivative, Chaos, Solitons and Fractals, 123 (2019) 43-51.

[4] T. Abdeljavad, On conformable fractional calculus, J. Comput. Appl. Math., 279 (2015) 57-66.

[5] M. Galach, Dynamics of the tumor-immune system competition-the effect of the time delay. Int. J. Math. Comput. Sci., 13(3) (2003) 395-406.

[6] Ş. Kartal, F. Gurcan, Discretization of conformable fractional differential equations by a piecewise constant approximation, Int. J. Comput. Math. 96(9) (2018) 1849-1860.

A generalization of Massera's theorem

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ABSTRACT

In the qualitative theory of differential equations, Massera type theorems have taken an important role since they establish a linkage between the existence of periodic and the existence of bounded solutions for dynamical equations and systems. The original result was published by José Luis Massera in 1950. Over the last few decades, Massera type theorems have been studied by several researchers for both linear and nonlinear equations and systems on continuous, discrete, and hybrid time domains. On the other hand, the mentioned result is also constructed for dynamical equations based on related periodicity notions such as almost periodicity, almost automorphy, and quasi-periodicity.

The primary aim of this talk is to provide an interpretation of Massera's theorem concerning a more general periodicity concept, so-called affine-periodicity, which covers conventional periodicity, anti-periodicity, and quasi-periodicity under certain conditions. To achieve the main goal of this presentation, we introduce a new boundedness concept, namely m_{Q,T}-boundedness, and then we acquire a relationship between the existence of m_{Q,T}-bounded solutions and (Q,T) affine-periodic solutions of linear dynamical systems by employing fixed point theory. As a conclusion, we touch on exponential dichotomy for homogeneous linear systems, commonly used as a tool in the existence of affine-periodic solutions of dynamical systems, and we propose a result which discusses the relationship between exponential dichotomy and m_{Q,T}-bounded solutions.

Key Words: Massera, affine-periodic, m_{Q,T}-bounded, Brouwer's fixed point theorem.

MSC: 34C25, 34K13, 34K12.

REFERENCES

[1] Y. Q. Chen, On Massera's theorem for anti-periodic solution, Adv. Math. Sci. Appl. 9 (1999) 125-128

[2] C. Cheng, F. Huang, Y. Li, Affine-periodic solutions and pseudo affine-periodic solutions for differential equations with exponential dichotomy and exponential trichotomy, J. Appl. Anal. Comput. 6 (4) (2016) 950-967.

[3] J.L. Massera, The existence of periodic solutions of systems of differential equations, Duke Math. J. 17 (4) (1950) 457-475.

[4] R. Ortega, M. Tarallo, Massera's theorem for quasi-periodic differential equations, Topol. Methods Nonlinear Anal. 19 (2002) 39-61.

A new single-strand smoothing technique and its usage in global optimization

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ABSTRACT

Smoothing techniques have received important attention in the last years. These techniques are used to approximate a non-smooth objective function to make it continuously differentiable by using smooth functions. This approximation is dominated by alterable parameters. Up to this time, smoothing techniques have been widely used to interact and solve problems in many important fields for example, the exact penalty function method, min-max problems, and global optimization. Smoothing techniques can be classified into two main types: first, global smoothing which is using the whole domain to approximate the objective function. The second one, the local smoothing which is using some neighbourhood of the kink points (these points are the points at which the objective function is not differentiable) to approximate the objective function. In this study, we introduce a new global smoothing technique for solving general unconstrained global optimization problems. This smoothing approximation technique is suggested for non-smooth functions with some numerical examples. The suggested technique is controlled by one adjustable parameter to smooth functions. We use the same above technique to construct a smoothing auxiliary function to solve unconstrained global optimization problem, then the global optimization algorithm and its properties are demonstrated. Finally, we give some numerical examples in order to explain the efficiency and effectiveness of our global optimization method.

Key Words: Global optimization, smoothing technique, auxiliary function.

MSC: 65, 68.

REFERENCES

[1] D. Bertsekas, Nondifferentiable optimization via approximation, Math. Program. Stud., 3 (1975) 1–25.

[2] I. Zang, A smoothing out technique for min-max optimization, Math. Programm., 19 (1980) 61–77.

[3] S. Xu, Smoothing method for minimax problems, Comput. Optim. Appl., 3 (2001) 267-279.

[4] Y.D. Sergeyev and D.E. Kvasov, A deterministic global optimization using smooth diagonal auxiliary functions, Commun. Nonlinear Sci., 1-3 (2015) 99-111.

[5] A. Sahiner, N. Yilmaz and S.A IBRAHEM, Smoothing Approximations to Non-smooth Functions. Journal of Multidisciplinary Modeling and Optimization, 2 (2018) 69-74.

On a bases problem for a Sturm-Liouville operator with eigenparameter- dependent boundary and transmission conditions

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ABSTRACT

Boundary value problems with eigenparameter-dependent boundary conditions have been growing interest with physical applications. In recent years there has been growing interest of Sturm-Liouville type problems with transmission conditions. This kind of boundary-value problems appear in solving several classes of partial differential equations, particularly, in solving heat and mass transfer problems, in vibrating string problems when the string loaded additionally with point masses and in various type of physical transfer problems.

Completeness and bases properties of the system of eigenfunctions of the Sturm-Liouville problem with a spectral parameter in the boundary conditions were studied in [1-3] and many authors.

In this work, we consider the boundary value problem for the differential equation

$$\ell(u) := -u'' + q(x)u = \lambda u, \quad x \in [-1,0) \cup (0,1], \tag{1}$$

where the real valued function $q(x)$ is continuous in $[-1,0) \cup (0,1]$, and has finite limits $q(\pm 0) = \lim_{x \to \pm 0} q(x)$, with boundary conditions

$$\alpha_{11}u(-1) - \alpha_{12}u'(-1) = \lambda(\alpha_{21}u(-1) - \alpha_{22}u'(-1)), \tag{2}$$

$$\beta_{11}u(1) - \beta_{12}u'(1) = \lambda\left(\beta_{21}u(1) - \beta_{22}u'(1)\right), \tag{3}$$

and transmission conditions

$$\gamma_3 u(+0) - \gamma_4 u(-0) = 0, \tag{4}$$

$$\gamma_2 u'(+0) - \gamma_1 u'(-0) + (\lambda\delta_1 + \delta_2)u(0) = 0, \tag{5}$$

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here λ is a complex parameter, $\alpha_{ij}, \beta_{ij}, \delta_k, \gamma_\ell \ (i,j,k=1,2,\ \ell=\overline{1,4})$ are arbitrary real numbers providing specific conditions. We give an operator theoretic formulation such a way that the boundary value problem under consideration can be realized as an eigenvalue problem for suitable differential operator.

The aim of this work is to investigate the problem of completeness, minimality and basis property of the eigenfunctions of the boundary value problem (1)-(5).

Key Words: Bases property, completeness, eigenfunctions.

MSC : 34110, 34B24, 47E05.

REFERENCES

[1] Kh. R. Mamedov, On a Basic Problem for a Second Order Differential Equation with a Discontinuous Coefficient and a Spectral Parameter in the Boundary Conditions, Softex, Sofia, Bulgaria, pp. 218-225, 2005.

[2] V. Y. Gulmamedov, Kh. R. Mamedov, On Basis Property for a Boundary Value Problem with a Spectral Parameter in the Boundary Condition, Journal of Arts and Sciences, Çankaya University, no:5, May 2006.

[3] M. Kadakal, O. Mukhtarov, Discontinuous Sturm-Liouville Problems Containing Eigenparameter in the Boundary Conditions, Acta Mathematica Sinica, English Series, Sep., vol. 22, no. 5 (2006) 1519-1528.

On the wave solutions of (2+1)-dimensional time-fractional Zoomeron equation

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ABSTRACT

In recent years, the partial differential equations (PDEs), as well as the fractional partial differential equations (FPDEs), have been the focus of many studies according to describe several physical phenomena and its applications in various fields of mathematics, physics, biology, and engineering. Finding exact solutions of PDEs and FPDEs attracted the attention of many researchers [1].

Researchers have been utilized various method to seek the solution of Zoomeron partial differential equation, such as enhanced-expansion method [2]. $\exp\left(-\varphi(\varepsilon)\right)$-expansion approach and modified Kudryashov method [3]. exponential rational function method, the sub-equation and generalized Kudryashov methods [4]. In this manuscript, we have applied a Bernoulli sub-equation [5] and sine-Gordon expansion method [6] to seek the traveling wave solutions of the (2+1)-dimensional time-fractional partial Zoomeron equation defined as follows [7].

$$D_{tt}^{2\alpha}\left(\frac{u_{xy}}{u}\right)-\left(\frac{u_{xy}}{u}\right)_{xx}+2D_t^{\alpha}\left(u^2\right)_x=0,\qquad 0<\alpha\le 1. \tag{1}$$

In this manuscript, we find the new exact solutions of this equation that describes the hyperbolic, trigonometric and fractional functions. The exact solutions of Zoomeron equation obtained by the sine-Gordon method are plotted in 3D and the effect of the fractional derivative α is illustrated in 2D figures as shown in Fig. 1 and fig. 2 while the exact solutions of Zoomeron equation obtained by Bernoulli sub-equation method are plotted in 3D and contour plot as shown in Fig. 3 and Fig. 4.
New soliton solutions can be introduced as:

Case 1 when $A_0=0, A_1=\dfrac{\mathrm{i}\sqrt{\varepsilon}\nu^{1/4}}{\sqrt{2}\kappa^{1/4}\left(2\varepsilon+\kappa^3\nu\right)^{1/4}}, B_1=\dfrac{\sqrt{\varepsilon}\nu^{1/4}}{\sqrt{2}\kappa^{1/4}\left(2\varepsilon+\kappa^3\nu\right)^{1/4}},\ \omega=-\dfrac{\sqrt{2\varepsilon+\kappa^3\nu}}{\sqrt{\kappa}\sqrt{\nu}},$

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$$u(x,t)=\frac{\sqrt{\varepsilon}\nu^{1/4}\left(sech\left(x\kappa+y\nu-\frac{t^{\alpha}\omega}{\Gamma(1+\alpha)}\right)+\mathrm{i}\tanh\left(x\kappa+y\nu-\frac{t^{\alpha}\omega}{\Gamma(1+\alpha)}\right)\right)}{\sqrt{2}\kappa^{1/4}\left(2\varepsilon+\kappa^{3}\nu\right)^{1/4}}. \tag{2}$$

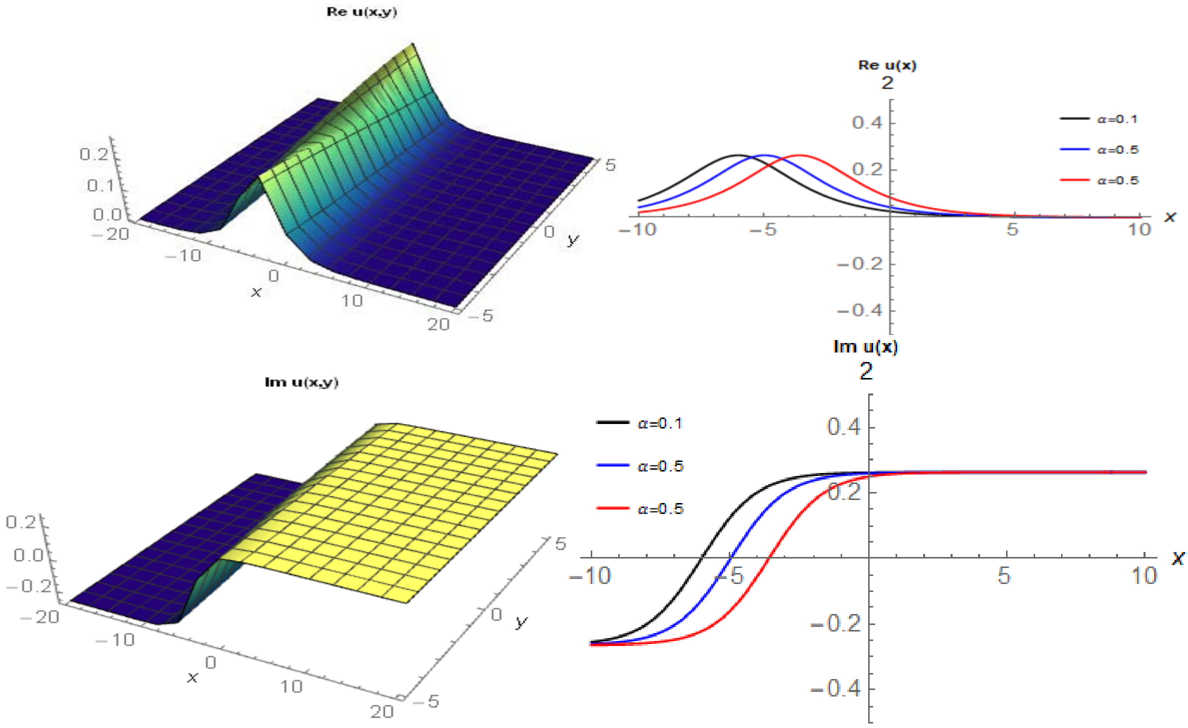

Fig. 1 the 3D and 2D of Eq. (22), when $\varepsilon=1$, $\kappa=0.9, \nu=0.1$, $\alpha=0.5, t=1/2$ and for 2D we choose $y=2$ for different value of α.

Case 2 when $A_0=0, A_1=\frac{\sqrt{\varepsilon}}{\sqrt{2}\sqrt{\kappa}\sqrt{\omega}}, B_1=\frac{\mathrm{i}\sqrt{\varepsilon}}{\sqrt{2}\sqrt{\kappa}\sqrt{\omega}}, \nu=-\frac{2\varepsilon}{\kappa^{3}-\kappa\omega^{2}}$,

$$u(x,y)=\frac{\sqrt{\varepsilon}\left(\mathrm{i}\,sech\left(x\kappa+y\nu-\frac{t^{\alpha}\omega}{\Gamma(1+\alpha)}\right)+\tanh\left(x\kappa+y\nu-\frac{t^{\alpha}\omega}{\Gamma(1+\alpha)}\right)\right)}{\sqrt{2}\sqrt{\kappa}\sqrt{\omega}}. \tag{3}$$

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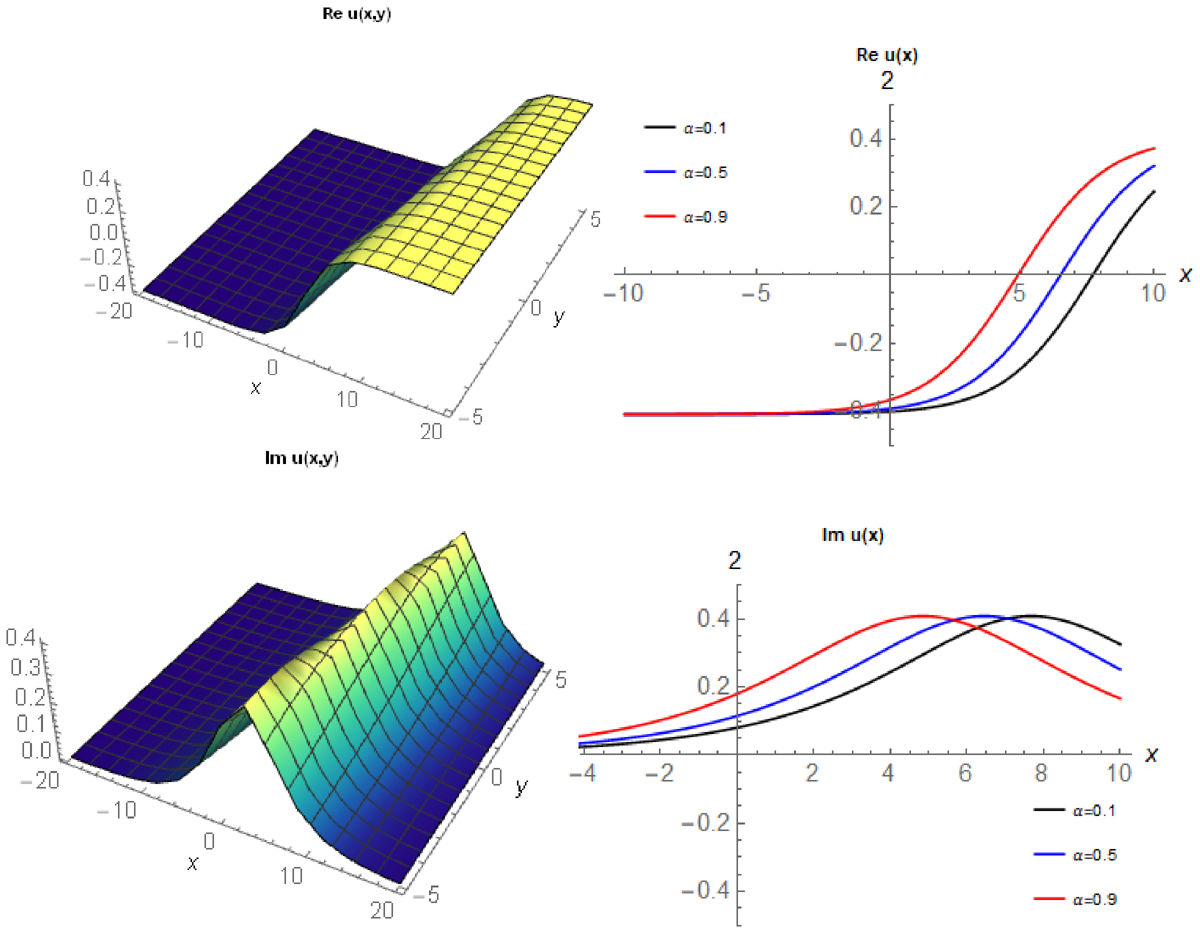

Fig 2 the 3D and 2D of Eq. (3), when $\varepsilon=1, \kappa=0.9, \omega=0.1, \alpha=0.5, t=1/2$ and for 2D, we choose $y=2$ with a different value of α.

Case 3 When $a_0=\frac{\sqrt{\varepsilon}\sqrt{\nu}\sqrt{\omega}}{\sqrt{2}\sqrt{\frac{\omega^2}{-\kappa^2+\omega^2}}\sqrt{\kappa\nu\left(-\kappa^2+\omega^2\right)}}, a_1=0, a_2=-\frac{2d\sqrt{\nu}\sqrt{\omega}}{\sqrt{\frac{\omega^2}{-\kappa^2+\omega^2}}}, b=-\frac{\sqrt{\varepsilon}}{\sqrt{2}\sqrt{\kappa\nu\left(-\kappa^2+\omega^2\right)}},$

$$u(x,y)=-\frac{2d\sqrt{\nu}\sqrt{\omega}}{\left(-\frac{d}{b}+ce^{-2b\left(x\kappa+y\nu-\frac{t^{\alpha}\omega}{\Gamma(1+\alpha)}\right)}\right)\sqrt{\frac{\omega^2}{-\kappa^2+\omega^2}}}+\frac{\sqrt{\varepsilon}\sqrt{\nu}\sqrt{\omega}}{\sqrt{2}\sqrt{\frac{\omega^2}{-\kappa^2+\omega^2}}\sqrt{\kappa\nu\left(-\kappa^2+\omega^2\right)}}. \quad (4)$$

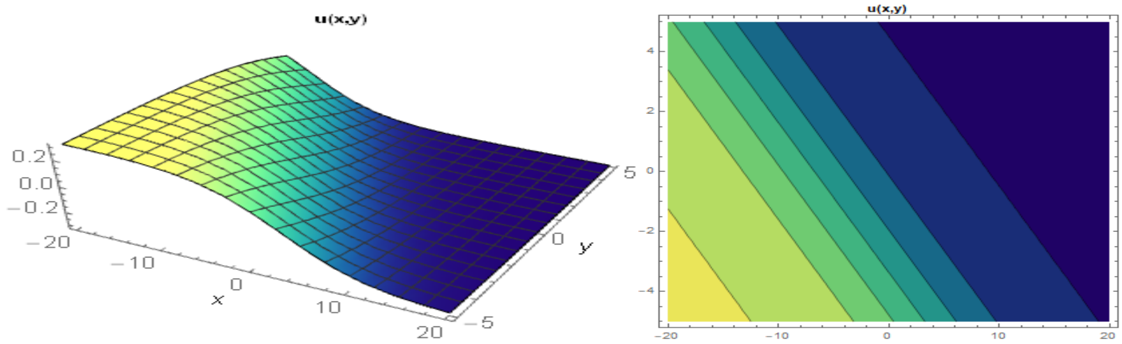

Fig. 3 3D and contour plot of Eq. (4), when

$\varepsilon = 0.2, \kappa = 0.5, \nu = 1, \alpha = 0.9, t = 1/2, c = 0.2, \omega = 0.9,$

Case 4 when $a_0 = \dfrac{\sqrt{\varepsilon}\sqrt{\nu\left(-\kappa^2+\omega^2\right)}}{\sqrt{2}\sqrt{\omega}\sqrt{\kappa\nu\left(-\kappa^2+\omega^2\right)}}, a_1 = 0, b = \dfrac{\sqrt{\varepsilon}}{\sqrt{2}\sqrt{\kappa\nu\left(-\kappa^2+\omega^2\right)}}, d = \dfrac{a2\sqrt{\omega}}{2\sqrt{\nu\left(-\kappa^2+\omega^2\right)}},$

$$u(x,y) = \frac{a_2}{-\dfrac{d}{b} + ce^{-2b\left(x\kappa + y\nu - \frac{t^{\alpha}\omega}{\Gamma(1+\alpha)}\right)}} + \frac{\sqrt{\varepsilon}\sqrt{\nu\left(-\kappa^2+\omega^2\right)}}{\sqrt{2}\sqrt{\omega}\sqrt{\kappa\nu\left(-\kappa^2+\omega^2\right)}}. \tag{5}$$

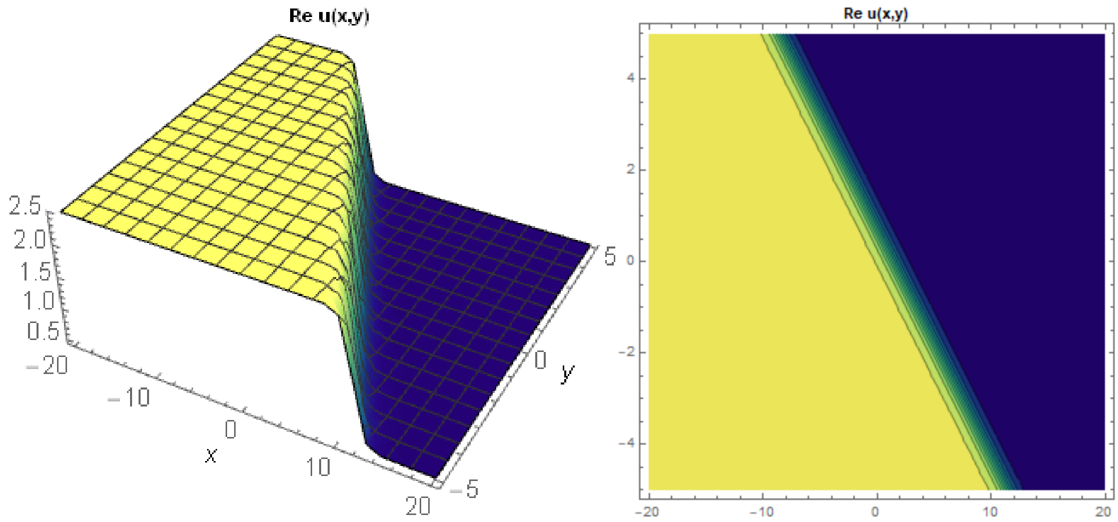

Fig. 4 3D and contour plot of Eq. (5) when

$\varepsilon = 0.2, \kappa = 0.5, \nu = 2, \alpha = 0.5, t = 1/2, c = 0.2, \omega = 2, \; a_2 = 1, d = 1, b = -1.$

Key Words: Fractional Zoomeron equation, Bernoulli sub-equation, sine-Gordon equation.

MSC: 32C81, 35L05.

REFERENCES

[1] E. Aksoy, A. C. Çevikel, and A. Bekir, “Soliton solutions of (2+1)-dimensional time-fractional Zoomeron equation,” *Optik (Stuttg).*, 2016.

[2] K. Khan and M. Ali Akbar, “Traveling wave solutions of the (2 + 1)-dimensional Zoomeron equation and the Burgers equations via the MSE method and the Exp-function method,” *Ain Shams Eng. J.*, 2014.

[3] K. Hosseini, A. Korkmaz, A. Bekir, F. Samadani, A. Zabihi, and M. Topsakal, “New wave form solutions of nonlinear conformable time-fractional Zoomeron equation in (2 + 1)-dimensions,” *Waves in Random and Complex Media*, 2019.

[4] N. Ahmed, S. Bibi, U. Khan, and S. T. Mohyud-Din, “A new modification in the exponential rational function method for nonlinear fractional differential equations,” *Eur. Phys. J. Plus*, 2018.

[5] H. M. Baskonus, “Complex Soliton Solutions to the Gilson–Pickering Model,” *Axioms*, 2019.

[6] H. M. Baskonus and H. Bulut, “New wave behaviors of the system of equations for the ion sound and Langmuir Waves,” *Waves in Random and Complex Media*, 2016.

[7] R. M. Morris and P. G. L. Leach, “Symmetry reductions and solutions to the Zoomeron equation,” *Phys. Scr.*, 2015.

System of intuitionistic fuzzy differential equations with intuitionistic fuzzy initial values

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ABSTRACT

Fuzzy set theory was firstly introduced by L. A. Zadeh in 1965 [1]. He defined fuzzy set concept by introducing every element with a function μ: X → [0, 1], called membership function. Later, some extensions of fuzzy set theory were proposed. One of these extensions is Atanassov's intuitionistic fuzzy set (IFS) theory [2].

In 1986, Atanassov introduced the concept of intuitionistic fuzzy sets and carried out rigorous researches to develop the theory. In this set concept, apart from the membership function, he introduced a new degree v: X → [0, 1], called non-membership function, such that the sum μ +v is less than or equal to 1. Hence the difference 1− (μ +v) is regarded as degree of hesitation. Since intuitionistic fuzzy set theory contains membership function, non-membership function and the degree of hesitation, it can be regarded as a tool which is more flexible and closer to human reasoning in handling uncertainty due to imprecise knowledge or data. Intuitionistic fuzzy set and fuzzy set theory have very compelling applications in various fields of science and engineering [3].

In literature, there are different approaches for solving fuzzy differential equations. Each method has advantages and disadvantages in the applications. One of the commonly used method is based on Zadeh's extension principle. In this method, the fuzzy solution is obtained from the crisp solution by using the well-known Zadeh's extension principle [4]. However, there is no definition of fuzzy derivative in this approach. Hence some other methods based on fuzzy derivative concept were also proposed and used. One of the earliest methods is Hukuhara differentiability concept [5]. However, this approach has also a weak point which is that the solution becomes fuzzier as time passes by. Hence the length of the support of the fuzzy solution increases.

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To overcome this disadvantage some methods such as differential inclusions and strongly generalized differentiability concept [6] were coined. The method based on strongly generalized differentiability concept allows us to obtain the solutions with decreasing length of support. Hence the drawback of Hukuhara differentiability can be overcome with strongly generalized Hukuhara differentiability concept. Besides, this approach shows to be more favourable in applications [7]. The main goal of this paper is to give solutions to system of differential equations under the special cases of strongly generalized differentiability (GH) concept, (i.e. i,ii-GH differentiability) [7] and under intuitionistic Zadeh's extension principle [8].

Key Words: Intuitionistic Fuzzy Sets, Strongly Generalized Hukuhara Differentiability, Intuitionistic Fuzzy Initial Value Problems, Intuitionistic Zadeh's Extension Principle.

MSC: 65, 68.

REFERENCES

[1] L. A. Zadeh, Fuzzy sets, Information and Control, 8(3) (1965) 38-353.

[2] K. T. Atanassov, Intuitionistic fuzzy sets, Fuzzy Sets and Systems, 20(1) (1986) 87–96.

[3] Ö. Akın, S. Bayeğ, Intuitionistic fuzzy initial value problems - an application, Hacettepe Journal of Mathematics and Statistics, (2017) Doi:10.15672/HJMS.2018.598.

[4] J.J. Buckley, T. Feuring, Fuzzy differential equations, Fuzzy Sets and Systems,110 (2000) 43–54.

[5] L. M. Puri, D. Ralescu, Differentials of fuzzy functions, Journal of Mathematical Analysis and Applications, 91(2) (1983) 552-558.

[6] B. Bede, S. G. Gal, Generalizations of the differentiability of fuzzy-number valued mappings with applications to fuzzy differential equations, Fuzzy Sets and Systems, 151(3) (2005) 581–599.

[7] B. Bede, I. J. Rudas, B. Bencsik, First order linear differential equations under generalized differentiability, Information Sciences, 177 (2007) 1648-1662.

[8] L. Atanassova, On intuitionistic fuzzy versions of L. Zadeh's extension principle. Notes on Intuitionistic Fuzzy Sets, 13(3) (2007) 33–36.

Local asymptotic stability analysis for a model with Michaelis-Menten type harvesting rate

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ABSTRACT

In this work, we transform a continuous-time model with Michaelis-Menten type harvesting rate into a discrete-time model by Nonstandard Finite Difference Scheme(NSFD). Nonstandard Finite Difference Scheme consists of two rules: The first discrete derivative is the form

$$\frac{dx}{dt} = \frac{x_{k+1} - x_k}{\varphi(h)}$$

where $\varphi(h)$ provides $\varphi(h) = h + O(h^2)$ and $\varphi(h)$ is defined as denominator function depends on the step size $\Delta t = h$. Some articles (Mickens 1994, Dimitrov and Kojouharov 2007, Elaydi 1999, Bairagi and Biswas 2016, Bairagi, Chakraborty and Pal 2012) can be consulted for information on how to make arbitrary selections of the denominator function. Also both linear and nonlinear terms may require a nonlocal representation on the computational system (Bairagi and Biswas 2016).

Establishing a numerical scheme for the system, we discretize the time variable $(t \geq 0)$ at $t_n = nh$ when h $(h > 0)$ is the step size. The solutions of system $x(t)$ and $y(t)$ at t_n are indicated by x_n and y_n respectively. To present stability analysis of a discrete time model with Michaelis-Menten type harvesting rate, the continuous-time model is discretizated. In this way, it was aimed to find positive solutions of the positive initial conditional problem. The numerical method shows dynamic consistency with its continuous counterpart.

However in this work, the local asymptotic stability states of the equilibrium points have been investigated. The first equilibrium point $E_1^* = (0,0)$ which is consistent with the dynamical behaviour of the continuous time model is found non-

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hyperbolic equilibrium point. Eigenvalues of the Jacobian matrix at the equilibrium $E_1^* = (0,0)$ are found as follows:

$$J(0,0) = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

The second equilibrium point $E_2^* = (1,0)$ is found locally asymptotic stable because it satisfy the Jury conditions. Finally if $h_1 < min\left(K_{E_3^*}, K_{E_3^*}^{\sim}\right)$, Jury conditions hold and the third equilibrium point $E_3^*(x^*, y^*)$ can be found stable fixed point. To illustrate this, the phase portrait and solution graphics of the discretized model are given.

Key Words: Stability analysis, equilibrium points, nonstandard finite difference scheme .

REFERENCES

[1] Bairagi, N, Biswas, M, A predator-prey model with Beddington-DeAngelis Functional Response: A non-standard finite-difference method. Journal of Difference Equations and Applications, 2016, 4, 581-593.

[2] Mickens, R.E, Nonstandard finite difference model of differential equations.World Scientific, Singapore, 1994.

[3] Bairagi, N., Chakraborty, S., Pal, S., Heteroclinic Bifurcation and Multistability in a Ratio-dependent Predator-Prey System with Michaelis-Menten Type Harvesting Rate, Proceedings of the World Congress on Engineering, London, U.K, 2012.

[4] Dimitrov, D. T., Kojouharov, H. V., Nonstandard Finite Difference Methods for Predator-Prey Models With General Functional Response, Technical Report 10, 2007.

[5] Elaydi, S N., An introduction to Difference Equations, Springer, New York, 1999.

A new discretization scheme for a computer virus model

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ABSTRACT

In this talk, a new model developed for computer viruses is analyzed. The model has presented to remove the protective restriction on the total number of computers related to Internet. In addition, a new numerical method has been developed for the model. The most important feature of this method is that the appropriate function can be selected instead of the step size. The selection of the appropriate denominator function prevents inconsistencies in the result of the problem.

Computers are called as nodes to be shortness when formulating the model. A node is defined internal or external depending on whether it is associated with the Internet or not. A node is defined infected or uninfected depending on whether it contains viruse or not. An infected node is called latent if the viruses in it or an infected node is called breaking-out if at least one virus in it. However, all internal nodes are categorized in to uninfected internal nodes (S nodes), latent internal nodes (L nodes) and breaking-out internal nodes (B nodes). All external nodes are categorized in to uninfected external nodes (S^* nodes), latent external nodes (L^* nodes) and breaking-out external nodes (B^* nodes). $S(t)$, $L(t)$ and $B(t)$ represent the numbers of S, L and B nodes at time t respectively (Yang 2014, Cohen 1987).

The denominator functions of a Computer virus model are chosen as,

$$\emptyset_1 = \frac{e^{\delta h} - 1}{\delta}$$

$$\emptyset_2 = \frac{e^{(\theta + \vartheta_1 + \delta + \alpha)h} - 1}{\theta + \vartheta_1 + \delta + \alpha}$$

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$$\emptyset_3 = \frac{e^{(\vartheta_2+\delta)h} - 1}{\vartheta_2 + \delta}$$

and some useful information about the local asymptotic stability of the discretized system has been proposed. In particular, in order to examine the Schur-Cohn criterion, which deals with the coefficient matrix of the linear system, the following information is used:

$$1 - trJ + detJ > 0$$

$$1 + trJ + detJ > 0$$

$$detJ < 1$$

where, J and trJ indicate the coefficient matrix and the trace of the matrix, respectively, of the linear system (Duffin 1969). Finally, some numerical results are given to illustrate the effect of the theoretical results.

Key Words: Computer viruses, numerical scheme, local asymptotic stability.

REFERENCES

[1] Yang, L, Yang, X, A new epidemic model of computer viruses, Communications in Nonlinear Science and Numerical Simulation, 19 (6) (2014) 1935-1944.

[2] Cohen, F, Computer viruses. Theory and experiments, Computers and Security, 1987.

[3] Elaydi S.N, An Introduction to Difference Equations, New York, 1999.

[4] Duffin, R.J, Algorithms for classical stability problems, Siam Review, 11 (2) 196-213, 1969.

[5] Chen. L, Hattaf. K, Sun. J, Optimal control of a delayed SLBS computer virus model, Statistical Mechanics and its applications, 427, 244-250, 2015.

Note on Laplacian spectrum of complementary prisms

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ABSTRACT

Let G = (V;E) be a simple graph with vertex set V = V (G) and edge set E = E(G). The Laplacian matrix of the graph G is the nxn matrix L(G) =D(G) - A(G) where D(G) = diag{d_1, d_2,…,d_n} is the diagonal matrix of vertex degrees and A(G) = (a_{ij}) is the (0, 1)-adjacency matrix of the graph G, that is, a_{ij} = 1 if i and j are adjacent vertices and a_{ij} = 0 otherwise.

L can be viewed as an operator on the space of functions f : V (G)→R satisfying

$$Lf(i) := d_i f(i) - \sum_{j,j\sim i} f(j)$$

In this work, the Laplacian spectrum of Complementary prisms graph is considered. The complementary prisms operation was introduced by Haynes et al. (Haynes et al 2009) and denoted by $G\overline{G}$. Some upper and lower bounds are got using majorization and operator definition of Laplacian. In (Cardoso et al. 2018), it is provided a result about the Laplacian spectrum of complimentary prisms. Supporting Cardoso et al.'s result about Laplacian spectrum of complementary prisms, an alternative proof about the lower and upper bound of nonzero minimum and maximum Laplacian eigenvalue is given. The following result is highlighted using operator definition of Laplacian;

$$\frac{(n+2)-\sqrt{n^2+4}}{2} \le \lambda_{min}(G\overline{G}) \text{ and } \lambda_{max}(G\overline{G}) \le \frac{(n+2)+\sqrt{n^2+4}}{2}.$$

where $\lambda_{min}(G\overline{G})$ and $\lambda_{max}(G\overline{G})$ are nonzero minimum and maximum Laplacian eigenvalues of complementary prisms graph, respectively.

Key Words: Graph Theory, Laplacian, Complementary Prisms.

MSC : 05C50, 05C76.

REFERENCES

[1] F.M. Atay, T. Bıyıkoglu, Graph operations and synchronization of complex networks, Physical Review E 72 (2005) 016217.

[2] D. M. Cardoso, P. Carvalho, M.A.A. de Freitas, C.T.M. Vinagre, Spectra, signless Laplacian and Laplacian spactra of complementary prisms of graphs, Linear Algebra and its Appl. 544 (2018) 325-338.

[3] S. Chaiken, A combinatorial proof of the all minors matrix tree theorem, SIAM J. Algebraic Discrete Methods 3 (1982) 319-329.

[4] C. Godsil, G. Royle, Algebraic graph theory, Graduate Texts in Mathematics, Springer-Verlag, New York, 2001.

[5] R. Grone, R. Merris, Coalescence, majorization, edge valuations and the Laplacian spectra of graphs, Linear Multilinear Algebra, 27 (1990) 139-146.

[6] T.W. Haynes, M.A. Henning, L.C. van der Merwe, Domination and total domination in complementary prisms, J. Comb. Optim. 18 (2009) 23-37.

[7] R. A. Horn, C. R. Johnson, Matrix Analysis, Cambridge University Press Cambridge, UK 1985.

[8] A.W. Marshall, I. Olkin, Inequalities: Theory of Majorization and Its Applications, Academic Press, New York, 1979.

[9] B. Mohar, The Laplacian spectrum of graphs, Graph Theory, Combinatorics, and Applications, 2 (1991) 871-898.

A global carleman estimate for the ultrahyperbolic Schrödinger equation

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ABSTRACT

In this study, we obtain a global Carleman estimate for an ultrahyperbolic Schrödinger equation. It is known that the Schrödinger equation describes the evolution of wave function of a charged particle under the influence of electrical potential and is the fundamental equation of quantum mechanics. Here, we deal with an ultrahyperbolic Schrödinger equation which is also called generalized Schrödinger equation. These equations arise in several applications, for example in water wave problems, [8], in higher dimensions as completely integrable models, [5] and in quantum kinetic theory, [2].

A Carleman estimate is an L_2 -weighted inequality with large parameter for a solution to a partial differential equation. In 1939, Torsten Carleman [6] established the first Carleman estimate for proving the unique continuation for a two-dimensional elliptic equation. In 1954, C. Müller extended Carleman's result to $\mathbb{R}^n$. Later, A. P. Calderón and L. Hörmander improved these results based on the concept of pseudo-convexity. Since then there have been great interest for the Carleman estimate and its applications. Recently, in the fields of the inverse problem and control theory, these estimates are applied in various ways to produce remarkable results, [7]. Carleman estimates for Schrödinger equation are obtained by a similar way in Baudouin and Puel [4], Mercado et al. [1], and Yuan and Yamamoto [3].

Key Words: Ultrahyperbolic Schrödinger equation, Carleman estimate.

MSC: 35Q40, 35Q41, 35R45.

REFERENCES:

[1] A. Mercado, A. Osses, L. Rosier, Inverse problems for the Schrödinger equation via Carleman inequalities with degenerate weights, Inverse Probl. 24 (2008) 015017

[2] A.K. Amirov, Integral Geometry and Inverse Problems for Kinetic Equations, VSP, Utrecht, 2001.

[3] G. Yuan, M. Yamamoto, Carleman estimates for the Schrödinger equation and applications to an inverse problem and an observability inequality, Chinese Ann. Math. B 31 (2010) 555-578.

[4] L. Baudouin, J.P. Puel, Uniqueness and stability in an inverse problem for the Schrödinger equation, Inverse Probl. 18 (2002) 1537

[5] M.J. Ablowitz, R. Haberman, Nonlinear evolution equations in two and three dimensions, Phys. Rev. Lett. 35 (1975) 1185

[6] T. Carleman, Sur un probleme, d'unicité pour les systemes d'équations aux derivées partiellesa deux variables independents, Ark. Mat. Astr. Fys. 2 (1939) 1-9

[7] M. Yamamoto, Carleman estimates for parabolic equations and applications, Inverse Probl. 25 (2009), 123013

[8] V.E. Zakharov, E.A. Kuznetsov, Multi-scale expansions in the theory of systems integrable by the inverse scattering transform, Phys. D 18 (1986) 455-463.

On an expansion formula for a singular Sturm-Liouville operator

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ABSTRACT

Expansion formulas according to the eigenfunctions for differential operators in infinite interval were investigated in [1-4] and by many authors. We consider the operator L_λ generated in half line $[0,\infty)$ by the Sturm-Liouville equation with the eigenvalue appearing non-linearly in the boundary condition.

In this paper, we consider on the half line the differential equation

$$\ell(y) \equiv -y'' + q(x)y = \lambda^2 y, \ \ (0 < x < +\infty) \tag{1}$$

with the boundary condition

$$y'(0) + i\lambda y(0) = 0, \tag{2}$$

here λ is a spectral parameter, $q(x)$ is a real valued function satisfying the condition

$$\int_0^\infty (1+x)\left|q(x)\right| dx < \infty. \tag{3}$$

The spectral analysis on the half line $[0,\infty)$ for the equation (1) with boundary condition linear dependence on the spectral parameter was studied in [5-6]. This type of boundary problem arises from a varied assortment of physical problems and other applied problems such as the study of heat conduction in [7] and wave equation in [8].

Two-fold expansion formulas according to the eigenfuctions were investigated for non-self adjoint boundary value problem with the boundary condition as the form (2) in [9]. In this paper we are interested in investigating the expansion formulas of the problem (1)-(2) in terms of scattering data. Using Jost solutions of equation (1) we define the scattering data of the problem (1)-(2) and in terms of scattering data we obtain the two fold spectral expansion formulas with respect to the eigenfunctions.

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Key Words: Expansion formula, scattering data, eigenfunctions.

MSC : 34110, 34B24, 47E05.

REFERENCES

[1] B.M. Levitan, I.S. Sargsjan, Introduction to Spectral Theory, American Mathematical Society, 1975.

[2] M. A. Naimark, Linear Differantial Operators, Frederick Ungar Publishing, 1967.

[3] E.C. Titchmarsh, Eigenfunctions Expansions,Oxford, 1962.

[4] V.A. Marchenko, Sturm Liouville Operators and Applications, AMS Chelsea Publishing, 2011.

[5] C.T. Fulton, ‘‘Two-Point Boundary Value Problems with Eigenvalue Parameter Contained in the Boundary Conditions’’, In. Proc. Roy. Soc. Edin., 87 A, 1-34.,1980.

[6] Kh. R. Mamedov,‘‘Spectral Expansion Formula for a Discontinous Sturm-Liouville Problem’’, NAS of Azerbaijan, 40, 275-282, 2014.

[7] D.S. Cohen, ‘‘An Integral Transform Associated with Boundary Conditions Containing an Eigenvalue Parameter", SIAM Journal on Applied Mathematics, 14, 5, 1164-1175, 1966.

[8] Freiling G., Yurko V.A., Lectures on Differential Equations of Mathematical Physcis, A First Course UK Edition, 2009.

[9] Kravickii A.O., Double Expansion into Series of Eigenfunctions of a Certain Non-Selfadjoint Boundary Value Problem, Diff., Uravneniya, 4, 165-177, 1968.

An inverse problem for an ultrahyperbolic equation with variable coefficients

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ABSTRACT

In this talk, an ultrahyperbolic equation with variable coefficients is considered under some Cauchy conditions. By using the given additional data on the solution, uniqueness of solution of an inverse problem of determining one of the coefficients in the equation is investigated. For this purpose, we reduce the inverse problem to a Cauchy problem for an integro-differential equation and then by using a pointwise Carleman type inequality we prove our main result.

As it is well-known hyperbolic equations include one time dimension and they are important in describing many dynamic evolutions of physical quantities in classical and quantum mechanics. The generalization of these equations to a theory which has multiple times is ultrahyperbolic equations. It is widely believed that multidimensionality of time violates the causality principle in classical physics and leads to the instability. On the other hand, the recent developments in the theoretical physics such as the string theory require additional time dimensions which makes ultrahyperbolic equations more interesting (Bars 2001, Craig and Weinstein 2009, Tegmark 1997).

Different inverse problems for ultrahyperbolic equations are studied in (Bukhgeim and Klibanov 1981, Amirov 2001, Golgeleyen and Yamamoto 2014) based on the Carleman estimates.

This is a joint work with Prof. Masahiro Yamamoto from University of Tokyo, Japan.

Key Words: Ultrahyperbolic equation, inverse problem, Carleman estimate.

MSC: 65M32, 35A02.

REFERENCES

[1] A.K. Amirov, Integral Geometry and Inverse Problems for Kinetic Equations. VSP, Utrecht, 2001.

[2] I. Bars, Survey of two-time physics, Class. Quantum Grav., 18 (2001) 3113–3130.

[3] M. Tegmark, On the dimensionality of space-time, Class. Quant. Grav., 14 (1997) L69–L75.

[4] W. Craig, S. Weinstein, On determinism and well-posedness in multiple time dimensions, Proc. Royal Society A, 465 (2009) 3023–3046.

[5] F. Gölgeleyen, M. Yamamoto, Stability of inverse problems for ultrahyperbolic equations, Chin. Ann. Math. B 35(4) (2014). 527-556.

[6] A.L. Bukhgeim, M.V. Klibanov, Global uniqueness of a class of multidimensional inverse problems. Dokl. Akad. Nauk. 260 (2) (1981) 269-272.

Existence of positive solutions for fractional *p*- Laplacian boundary value problems

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ABSTRACT

Fractional calculus is a generalization of ordinary differentiation and integration on an arbitrary order that can be non-integer. The subject of fractional calculus and fractional differential equations have obtained a considerable popularity and importance, mostly by virtue of their demonstrated applications in widespread fields of science and engineering. On the contrary to integer order differential and integral operators, fractional order differential operators are nonlocal in nature and provide the means to look into hereditary properties.

Lately, some scientists have become interested in the study of the fractional differential equations with *p*- Laplacian operators. For example, X. Liu and M. Jia consider a class of integral boundary value problems of fractional *p*–Laplacian equation. By using the generalization of Leggett-Williams fixed point theorem, some new results on the existence of at least three positive solutions to the boundary value problems are obtained.

In this talk, by using the Bai-Ge's fixed point theorem and the properties of Green's function, we establish the suitable criteria to guarantee the existence and multiplicity of positive solutions for nonlinear boundary value problems of fractional orders $2<\alpha, \beta\leq 3$ with integral boundary conditions. Only a few papers cover fractional differential equations with fractional orders $2< \alpha, \beta \leq 3$. Here, we study *p*-Laplacian equations with Riemann-Liouville fractional derivative. Due to the singularity of the Riemann-Liouville fractional derivative, it is very difficult to determine the initial value. The *p*-Laplacian operator is given by $\varphi_p(s) = |s|^{p-2}s$, where p>1. This operator is continuous, increasing, invertible and its inverse operator is φ_q, where q>1 is a constant such that $\frac{1}{p}+\frac{1}{q}=1$. An example is also given to demonstrate the main result.

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Key Words: Fractional *p*-Laplacian differential equation, fixed point theorem.

MSC : 34B10, 34B18.

REFERENCES

[1] A. A. Kilbas, H. M. Srivastava and J. J. Trujillo, Theory and applications of fractional differential equations, in: North-Holland Mathematics Studies, vol. 204, Elsevier Science B.V, Amsterdam, 2006.

[2] I. Podlubny, Fractional Differential Equations, Academic Press, San Diego, 1999.S.K. Godunov, A.G. Antonov, O.P. Kiriluk, V.I. Kostin, Guaranteed Accuracy in Mathematical Computations, Prentice-Hall, Englewood Cliffs, NJ, 1993.

[3] B. Ahmad, S. K. Ntouyas, and A. Alsaedi, New Existence Results for Nonlinear Fractional Differential Equations with Three-Point Integral Boundary Conditions, Advances in Difference Equations, Volume 2011, Article ID 107384, 11 p.

[4] Y. Li, G. Li, Positive solutions of p-Laplacian fractional differential equations with integral boundary value conditions, J. Nonlinear Sci. Appl. 9 (2016), 717–726.

[5] X. Zhang, L. Liu, B. Wiwatanapataphee, Y. Wu, The eigenvalue for a class of singular p-Laplacian fractional differential equations involving the Riemann-Stieltjes integral boundary condition, Appl. Math. Comput., 235 (2014), 412–422.1.

[6] S. G. Samko, A. A. Kilbas, O. I. Marichev, Fractional integrals and derivatives: theory and applications, Gordon and Breach, Switzerland, (1993).2.

Some borderenergetic graphs

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ABSTRACT

The energy $\mathcal{E}(G)$ of a graph G is defined as the sum of the absolute values of the eigenvalues of its adjacency matrix [1]. If a graph G of order n has the same energy as the complete graph K_n, i.e., if $\mathcal{E}(G) = 2(n-1)$, then G is said to be borderenergetic [2]. Borderenergetic graphs are widely studied in the literature, see [2,3,4].

In this work, the conditions under which the line graph of a strongly regular graph and k-regular graph are borderenergetic are obtained. First of all, let G be k-regular integral graph of order n with t eigenvalues greater than or equal to $2-k$ and no eigenvalues in the interval $(2-k, 0)$. Then we show that line graph $L(G)$ of G is borderenergetic if $\mathcal{E}(G) = k(n-2t)+4t-2$. Petersen graph with $n=10$ and $k=3$ is an example of this result. Next, let G be a strongly regular graph with parameters (n,k,λ,μ). Then we have that line graph $L(G)$ of G is borderenergetic if

$$2k-2n = \frac{-2(n-1)(k-\mu)+(n-1)(k-2)(\lambda-\mu)+k(\lambda-\mu)+2k(k-2)}{\sqrt{(\lambda-\mu)^2+4(k-\mu)}}$$

or

$$2k-2n = -\frac{-2(n-1)(k-\mu)+(n-1)(k-2)(\lambda-\mu)+k(\lambda-\mu)+2k(k-2)}{\sqrt{(\lambda-\mu)^2+4(k-\mu)}}.$$

For instance the line graph of $(2,1,0,0)$, $(3,2,1,0)$, $(6,3,0,3)$, $(10,3,0,1)$ and $(157,18,3,0)$ are borderenergetic.

Key Words: Borderenergetic graph, Petersen graph, Line graph, Strongly regular graph.

MSC: 05C50, 05C75, 05C76.

REFERENCES

[1] I. Gutman, The energy of a graph, Ber. Math. Stat. Sekt. Forschungsz. Graz 103, 1978, 1-22.

[2] S.C. Gong, X. Li, G.H. Xu, I. Gutman, B. Furtula, Borderenergetic graphs, MATCH Commun. Math. Comput. Chem. 74 (2015) 321-332

[3] B. Deng, X. Li and I. Gutman, More on borderenergetic graphs, Linear Algebra Appl. 497 (2016) 199-208.

[4] Z. Shao, F. Deng, Correcting the number of borderenergetic graphs of order 10, MATCH Commun. Math. Comput. Chem. 75 (2016) 263-266.

Approximate solution of an inverse problem for a stationary kinetic equation

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ABSTRACT

Kinetic equations are the fundamental equations of mathematical physics and modelize the continuity of motion of substance. They can be used for quantitative and qualitative description of many processes in physics, chemistry, biology and social sciences (Anikonov 2001). Inverse problems for kinetic equations are important both from theoretical and practical points of view. The physical meaning of these problems consists in determining particle interaction forces, radiation sources, scattering indicatrices and other physical parameters (Amirov 2001).

In this work, an inverse problem for a stationary kinetic equation with scattering term is considered in a bounded domain. A solution algorithm for the problem is developed based on the finite difference approximation and Newton-Cotes formulas. For this aim, we first reduce the overdetermined problem to determined one by the method developed by Amirov (2001). As a result of this procedure we obtain a Dirichlet problem for a third order partial differential equation. Next, we apply the finite difference and Newton-Cotes formulas to the derivatives and the integral term respectively. Finally, we obtain a system of linear algebraic equations which can be solved by a computer program. In order to show the effectiveness of the method some tables and graphs are presented.

The solvability of various inverse problems for kinetic equations was studied in Amirov (2001) and Anikonov (2001). Numerical solution algorithms for some inverse problems for kinetic and transport equations without scattering term were developed in Amirov et al (2009), Amirov et al (2011) and Golgeleyen (2013).

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Key Words: Kinetic equation, inverse problem, approximate solution.

MSC: 82B40, 65N21.

REFERENCES

[1] Y.E. Anikonov, Inverse Problems for Kinetic and other Evolution Equations, VSP, Utrecht the Netherlands, (2001).

[2] A.Kh. Amirov, Integral Geometry and Inverse Problems for Kinetic Equations, VSP, Utrecht the Netherlands, (2001).

[3] A. Amirov, F. Golgeleyen, A. Rahmanova, An Inverse Problem for the General Kinetic Equation and a Numerical Method, CMES, 43 (2) (2009) 131-147.

[4] A. Amirov, Z. Ustaoğlu, B. Heydarov, Solvability of a Two Dimensional Coefficient Inverse Problem for Transport Equation and a Numerical Method, Transport Theory and Statistical Physics 40 (1) (2011) 1-22.

[5] I. Golgeleyen, An Inverse Problem for a Generalized Transport Equation in Polar Coordinates and Numerical Applications, Inverse problems 29 (9) (2013) 095006.

A local Carleman type inequality for an ultrahyperbolic Schrödinger equation

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ABSTRACT

The Schrödinger equation is the fundamental equation of quantum mechanics and describes the evolution of the wave function of a charged particle under the influence of electrical potential. It has also important applications in atomic and molecular physics (Schrödinger 1926).

In this work, we consider an ultrahyperbolic Schrödinger equation which is also called generalized Schrödinger equation and occurs in some theories of modern physics such as quantum mechanics and string theory. Moreover, this equation arise in several applications, for example in water wave problems (Zakharov and Kuznetsov 1986), in higher dimensions as completely integrable models (Ablowitz and Haberman 1975) and in quantum kinetic theory. The local well-posedness of the initial value problem was proved in Kenig et all 2006 in some appropriate Sobolev spaces.

Based on the idea by Isakov 2006, we establish a local Carleman type inequality for the equation. A Carleman inequality is an L_2 - weighted a priori estimate and first used by Swedish mathematician Torsten Carleman in 1939 for proving the unique continuation for a two-dimensional elliptic equation. In 1954, C. Müller extended Carleman's result to $\mathbb{R}^n$. After that A. P. Calderón and L. Hörmander improved these results based on the concept of pseudo-convexity. By a similar way, various Carleman estimates for hyperbolic, parabolic, elliptic and Schrödinger equations are obtained in Isakov 2006, Amirov and Yamamoto 2005 and Yamamoto 2009 and they apply these to inverse problems.

Key Words: Ultrahyperbolic Schrödinger equation, local Carleman type inequality.

MSC: 35Q40, 35Q41, 35R45.

REFERENCES

[1] A.K. Amirov, M. Yamamoto, Unique continuation and an inverse problem for hyperbolic equations across a general hypersurface, J. Phys. Conf. Ser. 12 (2005) 1–12.

[2] C.E. Kenig, G. Ponce, C. Rolvung, L. Vega, The general quasilinear ultrahyperbolic Schrödinger equation, Adv. Math. 206 (2006) 402–433.

[3] M.J. Ablowitz, R. Haberman, Nonlinear evolution equations in two and three dimensions, Phys. Rev. Lett. 35 (1975) 1185.

[4] E. Schrödinger, An undulatory theory of the mechanics of atoms and molecules, Phys. Rev. 28 (1926) 1049–1070

[5] T. Carleman, Sur un probleme, d'unicité pour les systemes d'équations aux derivées partiellesa deux variables independents, Ark. Mat. Astr. Fys. 2 (1939) 1-9.

[6] M. Yamamoto, Carleman estimates for parabolic equations and applications, Inverse Probl. 25 (2009) 123013.

[7] V.E. Zakharov, E.A. Kuznetsov, Multi-scale expansions in the theory of systems integrable by the inverse scattering transform, Phys. D 18 (1986) 455-463.

[8] V. Isakov, Inverse Problems for Partial Differential Equations, Springer, New York, 2006.

An inverse source problem for a transport-like equation

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ABSTRACT

In this talk, we investigate the uniqueness and existence of the solution of a two-space-dimensional inverse problem for a transport-like equation which is related with a two-dimensional integral geometry problem (IGP) for a family of curves of given curvature. The main difficulty in studying our problem lies in its overdeterminacy. Therefore, the initial data for these problems cannot be arbitrary; they should satisfy some solvability conditions (Amirov 2001, Romanov 1974) which are difficult to establish. By using some extension of the class of unknown source functions, the overdetermined problem is replaced by the determined problem. This is achieved by assuming that the unknown function depends not only upon the space variable but also upon the direction in some special manner. This method of investigating the solvability of overdetermined inverse problems for transport equations was firstly proposed by Amirov (1986). We also obtain numerical solution of the problem by using the finite difference method.

Transport equations are used to model a number of different kinds of processes of particle transport, such as propagation of γ -rays in scattering media, neutron diffusion, scattering of light in the atmosphere, etc (Anikonov et al 2002, Case and Zweifel 1967, Anikonov 2001). Inverse problems for the transport equations have a variety of applications in theory of nuclear reactors, imaging techniques such as optical tomography. The problems of integral geometry have relevant applications; one of these is in tomography. The problems of integral geometry provide the mathematical background to tomography. The main goal of tomography is to recover the internal structure of a nontransparent object using external measurements. The object under investigation is exposed to radiation at different angles, and the radiation parameters are measured at the points of observation. The basic problem in computerized tomography is the reconstruction of a function from its line or plane integrals.

Key Words: Transport equation, Inverse Problem, Uniqueness, Existence.

MSC: 35A01, 35A02, 35R30.

REFERENCES

[1] A.K. Amirov, Integral Geometry and Inverse Problems for Kinetic Equations, VSP, Utrecht, 2001.

[2] V.G Romanov, Integral Geometry and Inverse Problems for Hyperbolic Equations, Berlin, Springer, 1974.

[3] A.K. Amirov, Existence and uniqueness theorems for the solution of an inverse problem for the transport equation, Sib. Math. J. 27 (1986) 785-800.

[4] D.S. Anikonov, A.E. Kovtanyuk, I.V. Prokhorov, Transport Equation and Tomography, VSP, Utrecht, 2002.

[5] K.M. Case, P.F. Zweifel, Linear Transport Theory, Reading, MA, Addison-Wesley, 1967.

[6] Y.E. Anikonov, Inverse Problems for Kinetic and Other Evolution Equations, VSP, Utrecht, 2001.

Asymptotic stability of linear delay difference equations including generalized difference operator

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ABSTRACT

Difference equations are the discrete analogues of differential equations and usually describe certain phenomena over the course of time. For a homogeneous linear difference equation , the stability of the or equilibrum point (or steady-state) zero is equivalent to the boundedness of all solutions for $n \geq 0$. For the asymptotic stability of the equilibrum point zero is equivalent to all solutions having zero limit as $n \to \infty$., which is true if and only if every root of the characteristic equation of homogeneous linear difference equation lies in the open disk $|\lambda| < 1$.

In this study some necessary and sufficient conditions are given for the stability of linear delay difference equations involving generalized difference operator. First we will consider the asymptotic stability of the zero solution of the linear homogeneous delay difference equation of the form

$$\Delta_{l,a}^{m} y(n-l) + r\Delta_{l,a} y(n) + sy(n) = 0$$

with initial conditions

$$y(i) = \varphi_i,\ i = 0,1,2,\dots,(m-1)l-1$$

and later we will consider the asymptotic stability of the zero solution of the linear homogeneous delay difference equation of the form

$$\Delta_{l,a}^{m} y(n-l) + r\Delta_{l,a} y(n) + sy(n-kl) = 0$$

with initial conditions

$$y(i) = \varphi_i,\ i = -kl, -kl+1, \dots, (m-1)l-1$$

where $a, r, s \in \mathbb{R}$ and $k, l, m, n \in \mathbb{N}$.

In [1] authors suggested the defnition of Δ as

$$\Delta y(n) = y(n+l) - y(n), l \in \mathbb{N}$$

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In our study the difference operator Δ and the generalized difference operator $\Delta_{l,a}$ are defined as

$$\Delta x(n) = x(n+1) - x(n)\ ,\ n \in \mathbb{N}$$

and

$$\Delta_{l,a} y(n) = y(n+l) - ay(n)\ l, n \in \mathbb{N}, a \in \mathbb{R}$$

respectively. In [2] and [3] authors found some using root analysis. In our study we obtained stability results using root analysis too. For the root analysis so-called Schur-Cohn criteria is used.

Key Words: Generalized Difference Operator, Schur-Cohn Criteria, Asymptotic Stability.

MSC : 39.

REFERENCES

[1] R. P. Agarwal, Difference Equations and Inequalities: Theory, Methods and Applications, Marcel Dekker, Newyork, NY, USA, (2000), 2nd edition.

[2] J. Cermák, J. Jánskı, J. & P. Kundrát, On necessary and Sufficient Conditions for the Asymptotic Stability of Higher Order Linear Difference Equations, Journal of Difference Equations and Applications(2011), Vol. 18, No. 11, 1781-1800.

[3] Dannan, F. M. and Elaydi, S., Asymptotic Stability of Linear Difference Equation of Advanced type, J. Comput. Anal. Appl.6 (2004), 173-187.

On the stability analysis of fractional-order Lotka-Volterra model with allee effect

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ABSTRACT

Let us consider t as the time parameter. The Lotka-Volterra predator-prey model consists of two differential equations, one equation for the prey x and the second equation for the predatory y. We have proposed following system of FODE (fractional-order differential equation) with multi-orders α_1 and α_2;

$$\begin{aligned} &D_t^{\alpha_1} x = r_x x(x-\beta_x) - \mu_x x - \omega xy \\ &D_t^{\alpha_2} y = r_y xy(y-\beta_y) - \mu_y y \qquad (1) \\ &0 < \alpha_1, \alpha_2 \leq 1 \end{aligned}$$

where $D_t^{\alpha_i}$ for $i = 1,2$ indicates α_i th-order fractional derivatives in the Caputo sense, it is $x = x(t)$ and $y = y(t)$ and the parameters have the properties

$$r_x, \beta_x, \mu_x, \omega, r_y, \beta_y, \mu_y \in \mathbb{R}^+. \quad (2)$$

In addition that, the system (1) has to be finished with positive initial conditions $x(t_0) = x_0$ and $y(t_0) = y_0$.

The parameters used in the model are definited as follows: the parameter r_x is the intrinsic growth rate of the prey x, whereas μ_x and μ_y are rates of natural death of prey and predator, respectively. In the absence of the prey, the predator population y approaches zero. The parameter ω is the per capita reduction in prey for per predator and r_y is the per capita increase in predator for per prey. β_x and β_y are the parameters descripting Allee effect. The Allee effect refers to reduced fitness or decline in population growth at low population sizes or densities. At low population densities the population is so widely dispersed that reproductive contacts are restricted and infrequent, In population models, the Allee effect is often modeled as a threshold, below which there is population extinction. Also, the terms ωxy and $r_y xy$ are referred to as functional and numerical responses, respectively.

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The qualitative analysis for the system (1) was performed. Also, the results of this analysis have supported by numerical simulations using Matlab.

Key Words: Mathematical model, fractional-order differential equation, stability analysis.

Mathematics Subject Classification: 92B05, 34D20.

REFERENCES

[1] Allen, L. J. S. (2007). An Introduction to Mathematical Biology.

[2] Daşbaşı, B. (2018). Stability Analysis of Mathematical Model including Pathogen-Specific Immune System Response with Fractional-Order Differential Equations. Computational and Mathematical Methods in Medicine (7930603), 1-10.

[3] Hassell, M. P. (1978). The Dynamics of Arthropod Predator-Prey systems. Princeton: Princeton University Press.

[4] May, R. M. (1976). Models for two interacting populations. Theoretical ecology: principles and applications , 49-70.

Investigation of Lorenz equation system with variable step size strategy

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ABSTRACT

In 1963, the famous meteorologist Edward Norton Lorenz studied to analyze the weather forecast and the idea of chaos emerged with his paper, "Deterministic Nonperiodic Flow". In later years, chaos was thought to be very useful for many technological disciplines and was studied extensively in mathematics and engineering.

The mathematical model of the Lorenz chaotic system has given as following:

$$dx/dt = \sigma(y-x), \quad dy/dt = rx-y-z, \quad dz/dt = xy-bz$$

where x, y and z are state variables; σ, b and r are positive constant parameters. If typical parameter values for a Lorenz System are chosen as $\sigma = 10$, $r = 28$ and $b = 8/3$, then the Lorenz system becomes chaotic. In chaotic case, the behavior of the solution changes rapidly, so the step size must be so small. This means numerical calculations have difficulties and long arithmetical operations.

In (Çelik Kızılkan, 2009 and Çelik Kızılkan and Aydın, 2012), a variable step size strategy has been proposed for numerical solutions of nonlinear differential equation systems such as Lorenz System. This strategy, allows to decide by performing error checking at each step, where to use the small step size and where the large step size should be used. So, it is possible to calculation at the desired error level. In this study, we have investigated the behavior of chaotic Lorenz system with the variable step size strategy in (Çelik Kızılkan, 2009 and Çelik Kızılkan and Aydın, 2012). We have obtained phase portraits for these chaotic system.

Key Words: Lorenz system, Numerical solutions, Variable step size strategy.

MSC: 37N30, 65P20.

REFERENCES

[1] C. Sparrow, The Lorenz Equations: Bifurcations, Chaos and Strange Attractors, Appl. Math. Sci., 1982.

[2] E. N. Lorenz, Deterministic Nonperiodic Flow, J. Atmos. Sci, Vol. 20, 130-141, 1963.

[3] E. Sermutlu, Comparison of Runge-Kutta Methods Order 4 and 5 on Lorenz equations, Çankaya Üniversitesi, Ankara, 2004.

[4] G. Çelik Kızılkan, K. Aydın, Step size strageties on the numerical integration of the systems of differential equation, PhD. Thesis, Selcuk University, Graduate School of Natural and Applied Science, Depertmant of Matematics, Konya, 2009.

[5] G. Çelik Kızılkan, K. Aydın, Step Size Strategies for the Numerical Integration of Differential Systems of ODEs, J. Comput. Appl. Math., 236 (15), 3805-3816, 2012.

[6] M. M. Sawalha, M. S. M. Noorani, On Solving the Lorenz System by Differential Transformation Method, ChinPhys Lett, 25 (4), 1-3, 2008.

A new approach to system of fractional differential equations in conformable sense

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ABSTRACT

The aim of this study is to apply conformable iterative Laplace transform method to system of fractional partial differential equations. The history of fractional calculus is based on the 17th century [1]. Since then, it has turned out that many phenomena in biology, chemistry, viscoelasticity, control theory, fluid mechanics, psychology, acoustics and other areas of science can be successfully modeled by the use of fractional derivatives [2]. Thus, so many derivative operators in fractional calculus have been introduced in the literature. Conformable derivative is one of these derivative operators and it is defined as

Conformable Derivative: Given a function $f:[0,\infty)\to \mathbb{R}$. Then Conformable derivative of f with respect to t of order α is defined by [3]

$$(T_\alpha f)(t)=\lim_{\varepsilon\to 0}\frac{f(t+\varepsilon t^{1-\alpha})-f(t)}{\varepsilon}$$

where $t>0$ and $\alpha\in(0,1]$.

Through out the study, some definitions and theorems needed are given first. And then the methodology of conformable iterative Laplace transform method is explained. After that, a numerical example of system of fractional partial differential equations is given for better understanding. It is seen that the method does not require any discretization, linearization and restrictive assumptions to reach the solutions. So it makes the numerical computations shorter. Also it can be said that this method is very effective and convenient to fractional differential equations.

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Key Words: Conformable derivative, Laplace transform, Fractional differential equations.

MSC: 34, 35.

REFERENCES

[1] MILLER, Kenneth S.; ROSS, Bertram. An introduction to the fractional calculus and fractional differential equations. 1993.

[2] Ortigueira, Manuel Duarte. Fractional calculus for scientists and engineers. Vol. 84. Springer Science & Business Media, 2011.

[3] KHALIL, Roshdi, et al. A new definition of fractional derivative. Journal of Computational and Applied Mathematics, 2014, 264: 65-70.

Lyapunov-type inequalities for even-order dynamic equations on time scales

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ABSTRACT

The theory of dynamic equations on time scales was first introduced by Stefan Hilger in his PhD thesis (Hilger 1988). It has been created in order to unify discrete and continuous analysis. The general idea is to prove a result for a dynamic equation where the domain of the unknown function is a so called time scale, which is an arbitrary closed subset of the reals. By choosing the time scale to be the set of real numbers, the general result yields a result concerning an ordinary differential equation and by choosing the time scale to be the set of integers, the same general result yields a result for difference equations. We may summarize the above and state that "Unification and Extension" are the two main features of the time scales calculus. By using the theory of time scales, we can also study biological, heat transfer, economic, stock market and epidemic models (Jones at all 2004, Thomas et all 2005, Atici et all 2006). Hence, the study of dynamic equations on time scales is worthwhile and has theoretical and practical values.

Lyapunov inequality is originally due to Aleksandr M. Liapounoff (Liapounoff 1947). Lyapunov inequality has proved to be useful tool in the studies of asymptotic theory, disconjugacy, boundary value problems, eigenvalue problems and numerous other applications in the theories of ordinary differential equations, difference equations and impulsive differential equations. Due to its importance, Lyapunov inequality has been improved and generalized in many forms (Kwong 1981, Cheng 1991, Guseinov and Zafer 2007). However, Lyapunov-type inequalities and their time scale versions are in early stages and therefore need to be improved.

Let $\mathbb{T}$ be an arbitrary time scale. In this study, our aim is to obtain new Hartman-type and Lyapunov-type inequalities for even-order dynamic equations of the form

$$x^{\Delta^{2n}}(t)+(-1)^{n-1}q(t)x^{\sigma}(t)=0,$$

satisfying the Lidstone boundary conditions

$$x^{\Delta^{2i}}(t_1)=x^{\Delta^{2i}}(t_2)=0; \qquad 0\le i\le n-1, \qquad t_1,t_2\in[t_0,\infty)_{\mathbf{T}},$$

where $q(t)$ is real-valued right-dense continuous function. By an interval $[t_0,\infty)_{\mathbf{T}}$, we mean the intersection of the real interval $[t_0,\infty)$ with the given time scale $\mathbf{T}$. The inequalities obtained generalize and complement the existing results in the literature.

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Key Words: Time scale, Lyapunov-type inequality, dynamic equation.

MSC: 34.

REFERENCES

[1] S. Hilger, Ein Masskettenkalkl mit Anwendug auf zentrumsmanningfaltigkeiten, Phd Thesis, Universitat Wurzburg, 1988.

[2] M.A. Jones, B. Song, D.M. Thomas, Controlling wound healing through debridement, Math. Comput. Modelling 40 (2004) 1057-1064.

[3] D.M. Thomas, L. Vandemuelebroeke, K. Yamaguchi, A mathematical evolution model for phytoremediation of metals, Discrete Contin. Dyn. Syst. Ser. B. 5 (2005) 411-422.

[4] F.M. Atici, D.C. Biles, A. Lebedinsky, An application of time scales to economics, Math. Comput. Modelling 43 (2006) 718-726.

[5] A.M. Liapounoff, Probleme général de la stabilitié du movement (French Translation of a Russian paper dated 1893). Ann. Fac. Sci. Univ. Toulouse 2 (1907) 27–247, Reprinted as Ann. Math. Studies, No. 17, Princeton, 1947.

[6] M.K. Kwong, On Lyapunov's inequality for disfocality, J. Math. Anal. Appl. 83 (1981) 486-494.

[7] S.S. Cheng, Lyapunov inequalities for differential and difference equations, Fasc. Math. 23 (1991) 25-41.

[8] G.Sh. Guseinov, A. Zafer, Stability criteria for linear periodic impulsive Hamiltonian systems, J. Math. Anal. Appl. 35 (2007) 1195–1206

Ulam' s type stability for Hadamard type fractional integral equations

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ABSTRACT

Hyer-Ulam stability is one of the main topics in the theory of functional equations. In 1940, the existence problem of given conditions of the functional equations from the linear mapping to approximately linear mapping was given by S.M. Ulam. In 1941, Hyers [2] responded to the question of Ulam for Banach space. This is known the first study in this field and many studies are given for generalizations of Ulam' s or the Ulam-Hyers type stability theory until today.

Since 1695, many researchers have been studied fractional calculus, today it is still a strong and growing subject in both theory and application. Fractional calculus has played a crucial role in different fields of science and engineering such as mechanics, electricity, biology, economics, physics, biophysics, control theory, and signal and image processing. In recent years, many mathematicians have studied on Hyers-Ulam stability of differential equations which have fractional derivative and integral in the various fields.

In 2013, Wang et al. [7] studied Ulam' s type stability of fractional differential equations involving Hadamard derivative. They obtained some Ulam-Hyers stability conditions by using method in [5].

In 2014, Wang and Lin [6] gave Ulam's type stability for fractional integral equations involving Hadamard type singular kernel on compact interval by using fixed point method. They extended and developed some results in [7] for same closed interval by using method in [5].

In 2016, Abbas et al. [1], by using Schauder's fixed-point theorem, presented Ulam stability results for partial integral equations via Hadamard's fractional integral.

In this paper, we deal with the Ulam type stability for the following fractional integral equations involving Hadamard type singular kernel in the space of continuous functions as defined in [3,4]:

$$y(x) = \sum_{j=1}^{m} \frac{c_j}{\Gamma(\alpha-j+1)}\left(ln\frac{x}{a}\right) + \frac{1}{\Gamma(\alpha)}\int_a^x \left(ln\frac{x}{\tau}\right)^{\alpha-1} u(\tau, y(\tau))\frac{d\tau}{\tau} \quad (1)$$

where $m-1 < \alpha \le m$ (m = 1,2,...), a and b are given constants such that $0 < a \le x \le b < \infty$, c_j is fixed real number for j=1,2,...,m, Γ is the Gamma function and u: $[a, b] x\, \mathbb{R} \longrightarrow \mathbb{R}$.

Motivating Wang and Lin [6], in this paper we investigate the Hyers-Ulam-Rassias and Hyers-Ulam stability of the Eq. (1) on a compact interval with the help of a new generalized metric definition and by using the fixed-point technique. We show that our results are better to some previous results.

Key Words: Hyers-Ulam stability, Hyers-Ulam-Rassias stability, Fractional integral equation.

MSC: 26A33, 34A34.

REFERENCES

[1] S. Abbas, W. Albarakati, M. Benchohra, M., J.J. Trujillo, Ulam stabilities for partial Hadamard fractional integral equations, Arab. J. Math., 5 (2016), 1–7.

[2] D. H. Hyers, On the stability of the linear functional equation, Proc. Natl. Acad. Sci. U.S.A. 27 (1941), 222–224.

[3] G.W. Leibniz, Letter from Hanover, Germany to G.F.A L'Hospital, September 30, 1695, Leibniz Mathematische Schriften, Olms-Verlag, Hildesheim, Germany, 1962, (First published in 1849) 301–302.

[4] G.W. Leibniz, Letter from Hanover, Germany to Johann Bernoulli, December 28, 1695, Leibniz Mathematische Schriften, Olms-Verlag, Hildesheim, Germany, 1962, (First published in 1849) 226.

[5] I.A. Rus, Ulam stability of ordinary differential equations, Studia Univ. "Babes¸ Bolyai" Mathematica, 54 (2009), 125-133.

[6] J. Wang, Z. Lin, Ulam's type stability of Hadamard type fractional integral equations, Filomat, 28 (2014), no.7, 1323-1331.

[7] J. Wang, Y. Zhou, M. Medved, Existence and stability of fractional differential equations with Hadamard derivative, Topol. Meth. Nonl. Anal., 41 (2013), 113-133.

The Levinson-Type Formula for a Scattering Problem

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ABSTRACT

The stationary state of system consisting to two particle and the energy is described by the function, which satisfies the Schrödinger equation in "Classical" quantum mechanics. The potential of the system depends only on the distance between these particles. The solutions of the boundary value problem, which are bounded at infinity, obtained by the method of separation of variables in the Schrödinger equation refers to as radial wave functions. The collection referred to as the scattering data of the boundary value problem is a complete description of the behaviour at infinity of all radial wave functions. Therefore, it is naturally to ask whether the behaviour of the solution functions at infinity determine the potential. In the other words, can one recover the potential from experimental data? [1]

The problem of recovering the potential from experimental data is known as the inverse problem of quantum scattering theory, because most of the fundamental data is obtained in experiments on the scattering of particles [1]. The inverse problem of scattering theory is to construct the potential uniquely according to scattering data.

In this study, we consider the inverse problem of scattering theory for a boundary value problem generated by second order differential equation with a linear spectral parameter in a boundary condition on the half line. The characteristics properties of the scattering data and the continuity of the scattering function $S(\lambda)$ are investigated on real line. In addition to these, we give the formula, called the Levinson-type formula, that expresses the relation between the increment of the argument of the scattering function $S(\lambda)$ and the singular number $\lambda_k\,(k=1,2,...,n)$ of boundary value problem in this study.

This study is related to the articles [2]-[5].

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Key Words: Scattering data, scattering function, Gelfand-Levitan-Marchenko equation, Levinson-type formula.

MSC: 34B05, 34B08, 34B24, 34L25.

REFERENCES

[1] V. A. Marchenko, Sturm-Liouville operators and applications, vol.22 of Operator theory: Advances and applications, Birkhauser: Basel,Switzerland, 1986.

[2] Kh. R. Mamedov, On the inverse problem for Sturm-Liouville operator with a nonlinear spectral parameter in the boundary condition, Journal of Korean Mathematical Society, 46(6), 1243–1254, 2009.

[3] Kh. R. Mamedov, Uniqueness of the solution of the inverse problem of scattering theory for the Sturm-Liouville operator with a spectral parameter in the boundary condition, Mathematical Notes, 74(1-2), 136-140, 2003.

[4] Kh. R. Mamedov, On an inverse scattering problem for a discontinuous Sturm-Liouville equation with a spectral parameter in the boundary condition, Boundary Value Problems, (2010), doi:10.1155/2010/171967, 2010.

[5] Kh. R. Mamedov and H. Menken, The Levinson-type formula for a boundary value problem with a spectral parameter in the boundary condition, The Arabian Journal of Science and Engineering, 34(1A), 219—226, 2009.

Computation of surface area established by spline functions

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ABSTRACT

Creation of one-dimensional spline functions was given by Graphic Constructor (A.Bulgak and D.Eminov, 2003). The cubic spline functions given in (A.Bulgak and D.Eminov, 2003) study were extended in two directions to form the solution visualision the Cauchy problem for linear one dimensional t-hyperbolic PDE in (O.Sinan and A.Bulgak, 2016). The value of any point on the surface was computed in (O.Sinan, 2016) with help of the partial derivative values defined in the cardinal points that characterize the resulting open surface. This computation will help in this study. $a, b, c, d \in \mathbb{R}$ and $\Omega = [a, b] \times [c, d]$ consider the rectangle on tOx plane as Ω region. Ω region divided into $(n-1) \times (m-1)$ subregions that

$$\omega_{i,j} = \{(t, x): t_i \leq t \leq t_{i+1}, x_j \leq x \leq x_{j+1}\}, i = 0,1, \cdots, m-2, j = 0,1, \cdots, n-2.$$

Computation of $f: \Omega \to \mathbb{R}, f(t, x)$ differentiable real functions were given in (O.Sinan and A.Bulgak, 2016) and (O.Sinan, 2016).

$\mathcal{E}_\Omega$ is represent the surface over established by $f: \Omega \to \mathbb{R}$ function on Ω region. $\mathcal{E}_{\omega_{p,r}}$ is the surface piece that relation with that take into account the particular one $\omega_{p,r}$; $p \in \{i \mid i = 0,1, \cdots, m-2\}$, $r \in \{j \mid j = 0,1, \cdots, n-2\}$.

The areas of the triangles forming consecutive contiguity at points that junction with surface at $f(t_p, x_r)$, $f(t_{p+1}, x_r)$, $f(t_p, x_{r+1})$, $f(t_{p+1}, x_{r+1})$, $f\left(\frac{t_{p+1}+t_p}{2}, \frac{x_{r+1}+x_r}{2}\right)$ were calculated with the vector norms. This treat was repeated at all subregions for area of $\mathcal{E}_\Omega$,

$$\Pi(\mathcal{E}_\Omega) \approx \sum_{i=0}^{m-2} \sum_{j=0}^{n-2} \Pi\left(\mathcal{E}_{\omega_{i,j}}\right).$$

For the purpose of better approximation, each subregions has to split to more $\widehat{\omega}$ segments. In synopsis, this exertion is an approach to the

$$\Pi(\mathcal{E}_\Omega) = \int \int_\Omega \sqrt{\left(\frac{\partial f}{\partial t}\right)^2 + \left(\frac{\partial f}{\partial x}\right)^2 + 1} \;\; dt\, dx$$

calculus for the function $f:\Omega \to \mathbb{R}$ defined by cubic spline functions except definition of f as $f\,(t,x) < 0$. Example results were provided by a computer console application that evolved in the course of this study. This console application attainable of *http://www.oguzersinan.net.tr/softwares* address.

Key Words: Spline functions, surface area.

MSC: 41, 45.

REFERENCES

[1] A.Bulgak and D.Eminov, Graphics Constructor2.0, Selcuk Journ. Appl. Math., Vol:4, No.1 (2003), 42-57.

[2] A.Bulgak and D.Eminov, Cauchy Solver, Selcuk Journ. Appl. Math., Vol:4, No.2 (2003), 13-22.

[3] H. Bulgak and D.Eminov, Computer dialogue system MVC, Selcuk Journ. Appl. Math., Vol:2, No.2 (2001), 17-38.

[4] O.Sinan and A.Bulgak, Visualisation of Cauchy problem solution for linear t-Hyperbolic PDE, Konuralp Journal of Mathematics, Vol:4, No:1 (2016), 193-202.

[5] O.Sinan, Partial derivative effects in two-dimensional spline function nodes., Konuralp Journal of Mathematics, Vol:4, No:2 (2016), 10-16.

Computation of the solutions of Sylvester and Stein matrix equations by iterative decreasing dimension method

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ABSTRACT

System of first order linear differential equation and system of first order difference equation has considered. The matrices of systems are $A \in M_N(\mathbb{C})$, $B \in M_P(\mathbb{C})$ and $C \in M_M^P(\mathbb{C})$. The existence of a solution of continuous and discrete time Sylvester matrix equations has been studied. For continuous – time, Sylvester matrix equation is $XA + BX = -C$ and the Stein matrix equation $BXA - X = -C$ for discrete – time system. This matrix equation plays a significant role in several applications in science and engineering such as evaluation of implicit numerical schemes for partial differential equations, decoupling techniques for ordinary differential equations, image restoration, signal processing, filtering, model reduction, block-diagonalization of matrices, computation of the matrix functions, and Control theory. Both matrix equations are transformed into a matrix vector equation $Gx = c$. Given that Vec operator is a vector valued function of a matrix, thus $c = Vec(C)$ and $x = Vec(X)$. When Kronecker product of Q and R matrices denoted by $Q \otimes R$ and Kronecker sum by $Q \oplus R$. For continuous – time systems, Sylvester matrix equation $G = A^* \oplus B$ and for discrete – time systems, Stein matrix equation $G = I_{N^2} - A^* \otimes B$ is obtain. It is determined whether the solutions of the obtained new systems are positively defined. These matrix equations have unique solutions if and only if G is non – singular. The equation $Gx = c$ may be solved by varied methods. The iterative decreasing dimension method (IDDM) (T.Keskin and K.Aydin, 2007) has implemented for solving the generated matrix vector equation. This method has arranged for equation $Gh = z$ and prepared for computer aided computation. At last, based on the calculated solutions of the these matrix equations, it was examined

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whether the systems are asymptotically stable. Computer computations have done with MAPLE procedures that run the constituted algorithms.

Key Words: Sylvester matrix equation, Stein matrix equation, IDDM.

MSC: 08, 68.

REFERENCES

[1] G. Alexander, Kronecker Products and Matrix Calculus with Applications, John Wiley & Sons, N.Y., (1981).

[2] G.H. Golub and C.F. Van Loan, Matrix Computations, The Johns Hopkins University Press, Baltimore, MD, (2013).

[3] H. Bulgak, Pseudo eigenvalues, spectral portrait of a matrix and their connections with different criteria of stability, in: Error Control and Adaptivity in Scientific Computing, H. Bulgak and C. Zenger, eds., NATO Science Series, Kluwer Academic Publishers, (1999), 95-124.

[4] K. Aydin, G. Kiziltan C., A.O. Cibikdiken, Generalized iterative decreasing method, European Journal of Pure and Applied Mathematics, Vol:3, No:5,(2010), 819-830.

[5] O . Akın. and H. Bulgak, Linear Difference Equations and Stability Theory [in Turkish], Selcuk University, Research Center of Applied Mathematics, Konya, (1998).

[6] T. Keskin and K. Aydin, Iterative decreasing dimension algorithm, Computers and Mathematics with Appl., Vol:53, No.1 (2007), 1153-1158.

Applications of Crank-Nicolson method to some random component partial differential equations

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ABSTRACT

In this study, the solutions of the random component partial differential equations are investigated by using Crank-Nicolson Method. Also, the parameters and the initial conditions of random component partial differential equations are examined by Gamma distribution. A few examples are specified to illustrate the influence of the solutions obtained with Crank-Nicolson Method. Functions for the expected values and variances of the numerical solutions of the random component partial differential equations are obtained. Crank-Nicolson Method for analyzing the numerical solutions of these partial differential equations is applied. On the other hand, the expected values and variances of these numerical solutions are calculated and the graphs of the expected values and variances are plotted in MATLAB software. Furthermore, the results for the random component partial differential equations with Gamma distribution are analyzed to examine effects of this distribution on the results. The results of the deterministic partial differential equations are compared with random characteristics of these partial differential equations. The influence of this method for the random component partial differential equations is analyzed by comparing the formulas for the expected values and variances with results from the simulations of the random component partial differential equations.

Key Words: Random Component Partial Differential Equation, Expected Value, Crank-Nicolson Method.

MSC: 35, 65.

REFERENCES

[1] G. D. Smith, Numerical Solution of Partial Differential Equations, Oxford University Press, 1965.

[2] G. Ekolin, Finite difference methods for a nonlocal boundary value problem for the heat equation, BIT 31, 245-261, 1991.

[3] C. Çelik, M. Duman, Crank–Nicolson method for the fractional diffusion equation with the Riesz fractional derivative, Journal of computational physics, 231(4), 1743-1750, 2012.

An advanced interactive web interface for step size strategies

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ABSTRACT

Nowadays, many software is used for mathematics education. The designed websites for using in mathematics education provides many facilities for students, teachers and more. The designed websites for mathematical calculations allow you to make quickly multi-step calculations that can be difficult or even impossible to do manually. The numerical integration of continuous time dynamical systems is a situation that requires making multi-step computation too.

It is important to choose the appropriate step size in the numerical integration of dynamical systems. In the literature, generally constant step sizes are used on numerical integration but there are studies suggesting variable step size for the effectiveness of the results too (Çelik Kızılkan 2004, Jorba and Zou 2005, Golberg 2007, Çelik Kızılkan 2009).

In this study, we have designed an interactive web interface providing the online using of given variable step size strategies in (Çelik Kızılkan 2004, Çelik Kızılkan 2009) with the thought of designing website that can be used in mathematics education. Technologies we have used for designing the website are Python programming language and Django web framework of its. Because Python has a simple syntax, powerful scientific computing libraries and many more useful properties. The web interface we have designed enables online use of five different step size strategies for the numerical integration of continuous-time dynamical systems up to 4x4 dimensions. We have released the web interface named "Step Size Strategies" we have designed at "https://stepsizestrategies.pythonanywhere.com".

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Key Words: Step size strategies, Numerical integration, Python, Web interface

MSC: 6520, 68U20, 65Y99.

REFERENCES

[1] A. Jorba, M. Zou, A software package for the numerical integration of ODEs by means of high-order Taylor methods, 2004.

[2] C. Toro, MathTools, https://www.mathstools.com/ 2012 (Erişim tarihi:10.05.2019).

[3] EMathHelp,http://www.emathhelp.net/calculators/differential-equations/euler-method-calculator/,2018, (Erişimtarihi 10.05.2019).

[4] First Order Differential Equation Solver,http://www.math-cs.gordon.edu/senning/desolver/, 2009, (Erişimtarihi 10.05.2019).

[5] G. Çelik Kızılkan, Baslangıç Deger Problemlerinin Nümerik Integrasyonunda Adım Genişliği Tespiti, Yüksek Lisans Tezi, Selçuk Üniversitesi, Fen Bilimleri Enstitüsü, 2004.

[6] G. Çelik Kızılkan Diferensiyel Denklem Sistemlerinin Nümerik İntegrasyonunda Adım Genişliği Stratejileri, DoktoraTezi, Selçuk Üniversitesi, Fen Bilimleri Enstitüsü, 2009.

[7] O. Golberg, Adaptive step size numerical methods for solving ordinary differential equations 2007.

A truncated Bell series approach to solve systems of generalized delay differential equations with variable coefficients

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ABSTRACT

In this study, a matrix method based on collocation points and Bell polynomials is improved to obtain the approximate solutions of systems of high-order generalized delay differential equations with variable coefficients. These kinds of systems characterized by the presence of linear functional delays play an important role in explaining many different phenomena and particularly, arise in industrial applications and in studies based on biology, economy, electro dynamics, physics and chemistry. The presented technique reduces the solution of the mentioned delay system under the initial conditions to the solution of a matrix equation with the unknown Bell coefficients. Thereby, the approximate solution is obtained in terms of Bell polynomials. In addition, some examples along with residual error analysis are performed to illustrate the efficiency of the method; the obtained results are scrutinized and interpreted. The method is easy to implement and produces accurate results. All numerical computations have been performed on the computer algebraic system Matlab.

Key Words: Bell polynomials and series, Collocation points and Matrix method, System of delay differential equations.

MSC: 34K06-34K28.

REFERENCES

[1] Oguz, C., Sezer, M. and Oguz, A. D., Chelyshkov collocation approach to solve the systems of linear functional differential equations, NTMSCI 3, No. 4, 83-97,2015.

[2] Bell E.T, Exponential polynomials, Ann. Math. 35(2):258-277,1934.

[3] Van Gorder R. A., Recursive Relations for Bell Polynomials of Arbitrary Positive Non-Integer Order,International Mathematical Forum 5(37):1819-1821,2010.

[4] Başar U, M Sezer. Numerical Solution Based on Stirling Polynomials for Solving Generalized Linear Integro-Differential Equations with Mixed Functional rguments,Proceeding of 2.İnternational university industry cooperation,r&d and innovation Congress.141-148,2018.

[5] Çam Ş,Stirling Sayıları.Matematik Dünyası,30-34,2005.

[6] Çetin M., Gürbüz B., Sezer M., Lucas Collocation Method for system of high order linear functional differential equtions, Journal of Science and Arts, Year 18, No. 4(45), pp. 891-910, 2018.

[7] Gökmen E.,Işık O.R. and Sezer M.,Taylor collocation approach for delayed Lotka-Volterra predator-prey system.Applied Mathematics and Computation,268,671-684,2015.

[8] Gökmen E., Sezer M, Taylor collocation method for systems of high-order linear differential-difference equations with variable coefficients.Ain Shams Engineering Journal,4,117-125,2013.

Projected differential transform method to some random component nonlinear partial differential equations with proportional delay

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ABSTRACT

In this study, the solutions of the random component nonlinear partial differential equations with proportional delay are analyzed by using Projected Differential Transform Method. Also, the parameters and the initial conditions of random component nonlinear partial differential equations with proportional delay are investigated by triangular distribution. A few examples are specified to illustrate the influence of the solutions obtained with Projected Differential Transform Method. Functions for the expected values and variances of the numerical solutions of the random component nonlinear partial differential equations with proportional delay are obtained. Projected Differential Transform for analyzing the numerical solutions of these partial differential equations is applied. On the other hand, the expected values and variances of these numerical solutions are calculated and the graphs of the expected values and variances are plotted in MATLAB software. Moreover, the results for the random component nonlinear partial differential equations with proportional delay by triangular distribution are analyzed to examine effects of this distribution on the results. The results of the deterministic partial differential equations are compared with random characteristics of these partial differential equations. The influence of this method for the random component nonlinear partial differential equations with proportional delay is analyzed by comparing the formulas for the expected values and variances with results from the simulations of the random component nonlinear partial differential equations with proportional delay.

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Key Words: Random Component Nonlinear Partial Differential Equation, Proportional Delay, Projected Differential Transform Method.

MSC: 35, 65.

REFERENCES

[1] D. K. Salkuyeh, M. Bastani, Solution of the Complex Modified Korteweg–de Vries equation by the projected differential transform method, Applied Mathematics and Computation, 219(10), 5105-5112, 2013.

[2] S. M. Elzaki, M. A. Bashir, L. Lajimi, Solution of linear and nonlinear partial differential equation by using projected differential transform method, Elixir Applied Mathematics, 40, 5234-5236, 2011.

[3] B. Jang, Solving linear and nonlinear initial value problems by the projected differential transform method, Computer Physics Communications, 181(5), 848-854, 2010.

[4] T. M. Elzaki, Application of Projected Differential Transform Method on Nonlinear Partial Differential Equations with Proportional Delay in One Variable, World Applied Sciences Journal, 30(3), 345-349, 2014.

Analytic solution of fractional heat equation via double Laplace Transform

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ABSTRACT

The topic of differential equations is one of the most important subjects in mathematics and other sciences. There are several methods to solve ordinary differential equations. However, there are no general methods to solve partial differential equations. One of the most powerful known tools to solve these equations is the integral transform method. The multi-variable Laplace transforms can be used to solve such equations. However, the theory of the multiple-variable Laplace transform is not completed yet. On the other hand, the fractional calculus is one of the most rapidly growing field of research. It has been gaining the attention of many scientists because of the interesting results obtained when these researchers utilized the fractional derivatives for the sake of modelling real world problems.

Maravall used the Laplace transform method to obtain the explicit solution of certain of ordinary differential equations with fractional derivatives. Oldham and Spanier also used the Laplace transform method to solve another type of homogeneous ordinary differential equations of fractional order. The Laplace transform was also used by Dorta, Seitkazieva, Miller and Ross to find solutions of such equations. Many authors like Gerasimov, Fedosov, Yanenko, Biacino, Miseredino and Fujita attempted to solve partial differential equations with fractional orders. But no one, to our knowledge attempted to solve fractional order partial differential equations using the double Laplace transform.

In this work, we establish the double Laplace formulas for the partial fractional derivatives and apply these formulas to solve a fractional heat equation with certain initial and boundary conditions.

Key Words: Fractional integral, Caputo fractional derivative, Double Laplace transform.

MSC: 26, 35.

REFERENCES

[1] D.G. Duff, Transform Methods for Solving Partial Differential Equations, Chapman and Hall/CRC, Boca Raton, F.L, 2004.

[2] T.A. Estrin, T.J. Higgins, The solution of boundary value problems by multiple Laplace transformation, Journal of the Franklin Institute 252 (2) (1951) 153-167

[3] A. Kılıçman, H.E. Gadain, on the applications of Laplace and Sumudu transforms, Journal of Franklin Institute 347 (2010) 848-862

[4] A. Kılıçman, H. Eltayeb, A note on integral transforms and partial differential equations, App. Math. Sc. 4(3) (2010) 109-118

[5] A.A. Kilbas, H.H. Srivastava and J.J. Trujillo, Theory and Applications of Fractional Differential Equations, Elsevier, Amsterdam. 2006.

[6] S.G. Samko, A.A.Kilbas, O.I. Marichev, Fractional Integrals and Derivatives- Theory and Applications, Gordon and Breach, Linghorne, P.A. 1993.

[7] I. Podlubny, Fractional Differential Equations, Academic Press, San Diego, CA, 1999.

[8] D. Unsworth, Am. J. Phys., 47 (11), 891–893 (1979).

A numerical approach based on Bell polynomials to solve of Fredholm integro differential equations with variable coefficients

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ABSTRACT

The main aim of this study is to apply the Bell polynomials for the solution of high order linear Fredholm integro-differential equations with a variable coefficient under the initial-boundary conditions. These kind equations characterized by the presence play an important role in explaining many different phenomena and particularly, arise in applied mathematics, industrial applications and in studies based on biology, economy, engineering, physics, mechanics, electrostatic and chemistry. The used technique in this study is essentially based on the truncated Bell series, their derivatives and its matrix representations along with collocation points; also it reduces the solution of the mentioned equation under the initial -boundary conditions to the solution of a matrix equation with the unknown Bell coefficients. Therefore, when the problem solved, the approximate solution is written in terms of Bell polynomials.The solutions are obtained as the truncated Bell series which are defined in the interval [a, b]. Also, by using the Mean-Value Theorem and residual function, an efficient error estimation technique is proposed, and some illustrative examples are presented to demonstrate the validity and applicability of the method. The numerical results obtained by using this method are compared in tables and figures.The method is easy to implement and produces accurate results. All numerical computations have been performed on the computer algebraic system MATLAB.

Key Words: Bell polynomials and series, Collocation points and Matrix method,Fredholm integro- differential equations.

MSC: 34K06-34K28.

REFERENCES

[1] U. Başar**,** M. Sezer, Numerical Solution Based on Stirling Polynomials for Solving Generalized Linear Integro-Differential Equations with Mixed Functional Arguments.Proceeding of 2. İnternational university industry cooperation,r&d and innovation Congress.141-148, 2018.

[2] S. Cam Stirling Sayıları.Matematik Dünyası, 2005.

[3] N. Baykus, M. Sezer, Laguerre polynomial solution of high order Fredholm integro-differential equations. NTMSCI 4(2): 273-284, 2016.

[4] R. A. Van Gorder, Recursive Relations for Bell Polynomials of Arbitrary Positive Non-Integer Order,International Mathematical Forum 5(37):1819-1821,2010.

[5] E.T. Bell, Exponential polynomials, Ann. Math. 35 ,258-277, 1934.

[6] T. Mollaoğlu, M. Sezer, A numerical approach with residual error estimation for evolution of high-order linear differential-difference equations by using Gegenbauer polynomials. Celal Bayar Üniversitesi Fen Bilimleri Dergisi,13 (1), 39-49, 2017.

[7] S. Yuzbası, An exponential method to solve linear Fredholm–Volterra integro-differential equations and residual improvement. Turk J Math 42: 2546 – 2562,2018.

[8] N. Kurt, M. Sezer ,Polynomial solution of high-order linear Fredholm integro-differential equations with constant coefficients. J. Frankin Inst. 345: 839–850,2008.

Iterative solutions for boundary value problem in the frame of a generalized Caputo derivative

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ABSTRACT

In this work, we discuss conditions for the existence of extremal solutions to a certain kind of fractional boundary value problems in setting of a generalized fractional derivative, the conditions of existence of maximal and minimal solutions are discussed. The conditions will be obtained by use of the monotone iterative method together with the method of upper and lower solutions. Because the monotone iterative method together with the method of upper and lower solutions are important tools for providing the existence and approximation of solutions to many applied problems of differential and integral equations (Li et all 2008, Li et all 2011).

The aforementioned method have been applied to study a coupled system of fractional differential equations with three-point boundary conditions in (Shan and Khan 2018) and a class of boundary value problem of nonlinear fractional order differential equations with the left Caputo derivative operator in (Ali et all 2019).

Therefore, inspired from the aforesaid works, we study the following boundary value problems of fractional order differential equations of the form

$$ {}_{a}^{c}D_{g}^{\alpha} x(t) + f(t, x(t)) = 0,\ t \in [0,1]\ ,\ 2 < \alpha \le 3, $$

subject to the conditions

$$ x(0) = x''(t)\big|_{t=0} = 0,\ x(1) = 0, $$

where $x \in C^{3}\left([0,1],\mathbb{R}\right)$, and we assume that $f:[0,1]\times\mathbb{R} \to \mathbb{R}$ is continuous. ${}_{a}^{c}D_{g}^{\alpha}$ denotes the left generalized Caputo fractional derivative operator of x of order α with

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respect to the continuous function g such that $g'(t) > 0, t \in [0,1]$, (Almedia 2017, Jarad et all 2017).

Key Words: Generalized Fractional Derivative, Extremal Solutions, Boundary Value Problems

MSC :34, 65.

REFERENCES

[1] Li F., Jia M., Liu X., Li C, Li G., Existence and uniqueness os solutions of second-order three point boundary value problems with upper and lower solutions in the reversed order, Nonlinear Anal Theory Methods Appl., 2008;68:2381-2388.

[2] Li F., Sun J., Jia M., Monotone iterative method for the second-order three point boundary value problems with upper and lower solutions in the reversed order, Comput Math Appl., 2011;217:4840-4847.

[3] S. Ali, K. Shah, F.Jarad, On stable iterative solutions for a class of boundary value problem of nonlinear fractional order differential equations, Math Meth Appl. Sci, 2019; 42:969-981.

[4] Almeida R., A Caputo fractional derivative of a function with respect to another function, Communications in Nonlinear Science and Numerical Simulation, 2017;44, 460-421.

[5] Jarad F., Abdeljawad T., Baleanu D., 2017, On the generalized fractional derivatives and their Caputo modification, Journal of Nonlinear Sciences and Applications 10(5), 2607-2619.

[6] Shah K., Khan RA., 2018, Iterative scheme for a coupled systems of fractional – order differential equations with three-point boundary conditions, Math Meth Appl Sci., 41:1047-1053

The difference scheme on Shishkin mesh for nonlinear singularly perturbed problem

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ABSTRACT

Singularly perturbed differential equations arise widespread in applications including geophysical fluid dynamics, oceanic and atmospheric circulation, physical chemistry and physics, describing the exothermic and isothermal chemical reactions, the steady-state temperature distributions heat transport problem, heat conduction, chemical engineering, under ground water flow, oceanograpy, meteorology etc. chemical reactions, and optimal control. The numerical processing of singularly perturbed differential equations gives great computational difficulties due to singularity and boundary (or interior) layers. For this reason, appropriate numerical methods such as the finite difference method should be used. Various researches have been developed by some authors for singular perturbation problems

In this study, absolutely accurate computational solution of nonlinear singularly perturbed differential equations with multi-point boundary conditions has been obtained on Shishkin mesh. Finite difference scheme is constructed and approxiation of the presented problem is obtained. According to ε- perturbation parameter, the first-order uniform convergence is found in the discrete maximum norm. A numerical experiment is studied to demon strate the effectiveness and accuracy of the present method. The results are demonstrated by table and figures.This study is prepared as follows: Section 2 provides a preliminary estimate about the solution of the problem and its derivatives. In section 3, Shishkin mesh is defined and then the finite difference scheme for the proposed problem is established. Uniform convergence of the method is investigated in section 4. Numerical example is carried out and its results are demonstrated on table and figures in section 5. Finally, conclusion and references is given last section.

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Key Words: Singular perturbation, finite difference method, Shishkin mesh, uniformly convergence, nonlocal condition.

MSC : 65, 34.

REFERENCES

[1] G.M. Amiraliyev and M. Cakir, Numerical Solution of Singularly Perturbed Problem with Nonlocal Boundary Condition, Appl. Math. Mech., 23(7): 755-764, 2002.

[2] D. Arslan, Finite Difference Method for Solving Singularly Perturbed Multi-Point Boundary Value Problem, J. Inst. Natural and Appl. Sci., 22(2): 64-75, 2017.

[3] M. Cakir and G.M. Amiraliyev, Numerical Solution of a Singularly Perturbed Three-Point Boundary Value Problem. Int. J. Comput. Math., 84(10):1465-1481, 2007.

Stability analysis of Crank-Nicolson method for simplified magnetohydrodynamics equations with linear time relaxation

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ABSTRACT

Magnetohydrodynamics (MHD) studies consider the dynamics of electrically conducting fluids. MHD are described by a set of equations, which are a combination of the Navier–Stokes equations of fluid dynamics and Maxwell's equations of electromagnetism. In most terrestrial applications, MHD flows occur at low magnetic Reynolds numbers.[1]

In this study, the stability analysis of time relaxation model obtained by adding linear differential filter term to Simplified Magnetohyrodynamic (SMHD) equations is investigated [2]. For this purpose, differential filter $\kappa(u-\overline{u})$ term is added to SMHD equations and SMHD Linear Time Relaxation Model (SMHDLTRM) is constructed . The algorithm of the model is discretized by Crank Nicolson (CN) method in time and the finite element method in space [3]. The pressure, velocity and electric potential spaces of the problem are given follow as

$$Q:=\{q\in L^2(\Omega): \int_\Omega q=0\}$$

$$X:=\{v\in H^1(\Omega)^d : v|_{\partial\Omega}=0\}$$

$$S:=\{\psi\in H^1(\Omega): \psi|_{\partial\Omega}=0\}.$$

The velocity, pressure and electric potential are given respectively $u:[0,T]\to X$, $p:[0,T]\to Q$, $\phi:[0,T]\to S$, $t\in(0,T]$. They satisfy the following SMHDLTRM algorithm;

$$N^{-1}\frac{d}{dt}(u,v)+N^{-1}(u\cdot\nabla u,v)+M^{-2}(\nabla u,\nabla v)-(p,\nabla\cdot v)+$$
$$(-\nabla\phi+u\times B,v\times B)+\kappa(u-\overline{u},v)=(f,v),\forall v\in X$$

$$(\nabla.u,q)=0,\ \ \forall q\in Q$$

$$(\nabla\phi - u\times B, \nabla\psi) = 0, \quad \forall\psi \in S,$$

$$u(x,0) = u_0(x), x \in \Omega,$$

$$\frac{d}{dt}(\bar{u}, v) = (\frac{u-\bar{u}}{\delta}, v)$$

We investigate the stability analysis for this algorithm with finite element method via Crank –Nicolson discretization.

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Keywords: Magnetohydrodynamics Equations, Crank Nicolson, Finite Element Method, Linear Time Relaxation

MSC : 35, 65, 76.

REFERENCES

[1] Davidson, P.A. (2001) An introduction to Magnetohydrodynamics.

[2] Layton, W. J. ve Neda, M. (2007) Truncation of scales by time relaxation, J. Math. Anal. 325: 788-807.

[3] Yüksel, G. ve Ingram R. (2013) Numerical analysis of A finite element, Crank- Nicolson discretization for MHD flows at small magnetic Reynolds numbers, Int J Numer Anal Model, 10(1): 74-98.

Using fuzzy logic in nomenclature of plant communities and determining syntaxonomic levels

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ABSTRACT

This paper presents a way of logical and numerical description of the phytosociological analysis. The vagueness of vegetation units has been explicated by means of formal tools developed by fuzzy set theory. The vegetation analysis has been presented as a linguistic variable *community type* (*ct*). A set of its linguistic values (*Tct*) contains names of syntaxa (as primary terms) and some compound terms. According to the linguistic approach proposed, identification of a plant association is based on its floristic composition and consists in the assigning the most appropriate term in tct to this plant association. The method used here is called as linguistic approximation. The logical differences between taxa and syntaxa, and the numerical application of the variable ct in expert systems have been discussed (Moraczewski 1993). The preferred of using of FST as the conceptual basis for vegetation science seems to be appropriate. FST is principally convenient for the description of complex systems (Zadeh 1972), and therefore for plant communities (Andreucci et al. 2000, Ochoa-Gaona et al. 2010).

This method makes it possible to analyze the problems related to vegetation researches and serves as a emergency service in cases where it is difficult to express verbally.

Solutions to problems such as identification of plant communities, hierarchical problems in plant sociology, and finally, the provision of responses to expressions in plant sociology studies can be produced.

Key Words: Fuzzy Set Theory (FST), identification of plant communities, linguistic variable, vegetation and phytosociological analysis.

REFERENCES

[1]. I. R. Moraczewski, fuzzy logic for phytosociology, vegetatio 106 (1993) 1–11.

[2]. Zadeh, l. A. 1975. The concept of a linguistic variable and its application to approximate reasoning. Part i, information sciences 8: 199-249; part ıı, ınformation sciences 8: 301-357; part ııı, ınformation sciences 9: 43-80.

[3]. Zadeh, l. A. 1983. The role of fuzzy logic in the management of uncertainty in expert systems. Fuzzy sets and systems 11: 199-227.

[4]. F. Andreucci, e. Biondi, e. Feoli, v. Zuccar. 2000. Modeling environmental responses of plant associations by fuzzy set theory. Community ecology. 73-80.

[5]. S. Ochoa-gaona, c. Kampichler, b.h.j. de jonga, s. Hernández , v. Geissena, e. Huertaa. 2010. A multi-criterion index for the evaluation of local tropical forest conditions in mexico. Forest ecology and management 260 (2010) 618–627.

A numerical method for an inverse problem for a non-stationary kinetic equation

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ABSTRACT

In this work, an inverse problem for a general non-stationary kinetic equation with scattering term is considered. Inverse problems for kinetic equations have many applications in science and technology. The physical meaning of these problems consists in finding particle interaction forces, scattering indicatrices, radiation sources and other physical parameters. Interesting results in this field are presented in Amirov (1986), Amirov and Pashaev (1992), Anikonov and Amirov (1983), Pestov and Sharafutdinov (1988). Solvability of various inverse problems for kinetic equations were studied in Amirov (2001) and Anikonov (2001). Numerical solution algorithms for similar inverse problems for stationary kinetic and transport equations without scattering term were developed by Amirov et al (2011), Amirov et al (2009).

The main purpose of this study is to propose a numerical method to obtain the approximate solution of the problem. For this aim, we apply the finite difference approximation to the derivatives in the equation and trapezoid method, Simpson's rule and Newton Cotes formula's to the integral term respectively. Exact and approximate solution of the problem are compared with the help of tables and graphs. The computational results show that the proposed method gives highly effective solutions.

Key Words: Inverse problem, kinetic equation, finite difference method, trapezoid rule

MSC : 35R30, 65N21.

REFERENCES

[1] A. Kh. Amirov, Existence and Uniqueness Theorems for the Solution of an Inverse Problem for the Transport Equation, Siberian Mathematical Journal, 27: 785-800, 1986.

[2] A. Kh. Amirov, Integral Geometry and Inverse Problems for Kinetic Equations, VSP, Utrecht The Netherlands, 2001.

[3] A. Amirov, F. Gölgeleyen and A. Rahmanova A, An Inverse Problem for the General Kinetic Equation and a Numerical Method, CMES, 43 (2): 131-147, 2009.

[4] A. Amirov, Z. Ustaoğlu and B. Heydarov, Solvability of a Two Dimensional Coefficient Inverse Problem for Transport Equation and a Numerical Method, Transport Theory and Statistical Physics, 40 (1): 1-22, 2011.

[5] Yu. E. Anikonov,and A. Kh. Amirov, A Uniqueness Theorem for the Solution of an Inverse Problem for the Kinetic Equation, Doklady Akademii Nauk SSSR, 272 (6): 1292-1293, 1983.

[6] A. Kh. Amirov and R.T. Pashaev, An inverse problem for the wave equation, Soviet Math. Dokl., 44, No: 1, 121-122, 1992.

[7] Yu. E. Anikonov, Inverse Problems for Kinetic and other Evolution Equations, VSP, Utrecht The Netherlands, 2001.

[8] L.N. Pestov and V.A. Sharafutdinov, Integral geometry of tensor fields on a manifold of negative curvature, Soviet Math. Dokl., 36, No. 1,203—204, 1988.

Behavior of solutions of high order difference equations systems

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ABSTRACT

Theoretically, estimating the behavior of solution of a problem provides significant advantages in its application areas. Also, knowing under which conditions the structure and character of the problem are protected under perturbations in the input elements of the problem prevents to cause chaos (Duman, 2008). For a difference equation system, two important concepts about the behavior of the solution are "Schur stability" and "oscillation". Schur stability provides to obtain some information about the behavior of the solution without calculating the exact solution of the system (Akın and Bulgak, 1998; Aydın and Duman, 2011; Duman et all, 2018). Oscillation allows to understand how the solution of a difference equation system has a behaviour and how the external effects that affect it will change the behavior of the solution (Agarwall et all, 2000; Elaydi, 2005; Sunday, 2018).

In this study, it has been discussed Schur stability and oscillation of the behavior of high order difference equation systems. Some results related with the disturbance of the Schur stability and oscillation have been obtained. The difference between the quality of Schur stability according to eigenvalues and the quality of Schur stability according to the $\omega(A)$ parameter has been examined. A new criterion has been given for high order difference equation systems to be both Schur stable and oscillating. Results have been obtained related with optimum oscillation, practical oscillation and continuity of oscillation. It has been examined whether high order difference systems can be both Schur stable and oscillating. In addition, the obtained results have been supported with numerical examples. They have been compared with the results in the literature.

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Key Words: Difference equation systems, Oscillation, Schur stability.

MSC: 39A30

REFERENCES

[1] R.P. Agarwal, S. R. Grace, D. O' Reagan, Oscillation Theory For Difference And Functional Differential, Kluwer Academic Publishers, London, 2000.

[2] Ö. Akın, H. Bulgak, Linear Difference Equations and Stability Theory, Selcuk University Publications, Konya, 1988.

[3] K. Aydın, A. Duman, Sensitivity of Schur Stability of Systems of Linear Difference Equations with Constant Coefficients, Scientific Research and Essays Vol.6 (28), pp. 5846-5854, 2011.

[4] A. Duman, Sensitivity of Schur Stability of Periodic Linear Difference Equations, PhD Thesis, Selcuk University Institute of Science and Technology, 2008

[5] A. Duman,G. Kızılkan Çelik, K. Aydın, Sensitivity of Schur Stability of the k-th Order difference Equation System y(n+k)=Cy(n), Konuralp Journal of Mathematics, 6(1)(2018)7-13, 2018.

[6] S. Elaydi, An Introduction to Difference Equations, Springer, New York, 2005.

[7] J. Sunday, On the Oscillation Criteria and Computation of Third Order Oscillatory Differential Equations, Communications in Mathematics and Applications, Vol. 9, No. 4, pp. 615-626, 2018.

An application on the comparison of numerical and semi-analytical methods

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ABSTRACT

In the last decades, many authors have produced excellent results in mathematical modelling and solving the models which have constructed in different fields of sciences and engineering. Because most of the models and systems are nonlinear, solution methods and determining of their stability regions have an important role. Moreover, fractional calculus theory, which is well-known as the generalization of the integer-order calculus, it is a rapidly advancing field of mathematics, physics, engineering, finance and artificial intelligence. It has been attracting the interest of many researchers because of the results got when it is applied to the real world models [1-3].

This paper addresses to determine the difference and effectiveness between some analytical, numerical and approximate-analytical methods. Firstly, we have considered an analytical method namely $(1/G')-$expansion method. We have solved a kind of time-fractional partial differential equation analytically by using the $(1/G')-$expansion method and we have got an exact solution for the equation. Then we have obtained a numerical solution of the equation by using the finite difference method (FDM). Moreover, we have solved the mentioned fractional differential equation by using an approximate-analytical method namely Laplace homotopy perturbation method (LHPM). This method is combined with Laplace transformation and homotopy perturbation method [4]. On the other hand, we have used as fractional parameter the Caputo derivative [5] which is a well-known operator in modelling and solving differential equations of fractional order.

In this paper, we have compared the results obtained with FDM and LHPM in terms of figures and tables. According to the results obtained in this study, we can

say that the $\left(1/G'\right)-$expansion method, FDM and LHPM are very effective and accurate methods in finding exact, numerical and approximate analytical solutions, respectively. In addition, we have concluded that the FDM solution is closer to the exact solution.

Key Words: $\left(1/G'\right)-$expansion method, finite difference scheme, Laplace transformation, homotopy perturbation method, Caputo fractional derivative.

MSC : 26A33, 65L12, 44A10.

REFERENCES

[1] J. Hristov, Space-Fractional Diffusion with a Potential Power-Law Coefficient: Transient Approximate Solution, Progress in Fractional Differentiation and Applications, 3(1), 19-39, 2017.

[2] M. Yavuz and E. Bonyah, New Approaches to the Fractional Dynamics of Schistosomiasis Disease Model. Physica A: Statistical Mechanics and its Applications, 525, 373-393, 2019.

[3] H. Jafari, B. Mehdinejadiani, and D. Baleanu, Fractional Calculus for Modelling Unconfined Groundwater. Applications in Engineering, Life and Social Sciences, 119, 2019.

[4] V.F. Morales-Delgado, J.F. Gómez-Aguilar, H. Yépez-Martínez, D. Baleanu, R.F. Escobar-Jimenez, and V.H. Olivares-Peregrino, Laplace Homotopy Analysis Method for Solving Linear Partial Differential Equations Using a Fractional Derivative with and without Kernel Singular, Advances in Difference Equations, 2016(1), 164, 2016.

[5] I. Podlubny, Fractional Differential Equations: An Introduction to Fractional Derivatives, Fractional Differential Equations, to Methods of Their Solution and Some of Their Applications (Vol. 198). Elsevier. 1998.

Algorithm for Schur stability of an interval matrix

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ABSTRACT

It is well known that the Schur stability of the difference equation system

$$x(n+1) = Ax(n),\ n \in Z \tag{1}$$

is equivalent to the Schur stability of coefficient matrix A, where $A \in M_N(\mathbb{R})$ and $x(n) \in \mathbb{R}^N$ (Elaydi 1996, Akın and Bulgak 1998). If A is Schur stable then the value

$$\omega(A) = \|H\|;\ H = \sum_{k=0}^{\infty} (A^*)^k A^k$$

is known as Schur Stability parameter of the system (1), where $H = H^* > 0$ is the solution of the Lyapunov matrix equation $A^*HA - H + I = 0$. The parameter $\omega(A)$ is a parameter that shows the quality of Schur stability of a matrix A. Linear difference system (1) is Schur stable if and only if $\omega(A) < \infty$ holds (Akın and Bulgak 1998, Duman and Aydın 2011).

Let $\boldsymbol{A} \in M_N(\mathbb{R})$ be an interval matrix, $x(n) \in \mathbb{R}^N$ and let us consider the following difference equation system

$$x(n+1) = \boldsymbol{A}x(n)\ ;\ \boldsymbol{A} = \left\{A = \left(a_{ij}\right) \in M_N(\mathbb{R}),\ a_{ij} \in \left[\underline{a}_{ij}, \overline{a}_{ij}\right]\right\}, \tag{2}$$

where $\left[\underline{a}_{ij}, \overline{a}_{ij}\right]$ are the intervals of the real numbers (Bulgak and Bulgak 2001). As in Schur stability of system (1), Schur stability of system (2) is equivalent to the stability of the coefficient matrix $\boldsymbol{A}$, too. So, it is important to examine the stability of the interval matrix. If the matrices $A \in \boldsymbol{A}$ are Schur stable, then the interval matrix $\boldsymbol{A}$ is called as Schur stable (Bulgak 2001).

In this study we developed an algorithm for Schur stability of an interval matrix $\boldsymbol{A}$. The algorithm is a modification of Bulgak's algorithm given in (Bulgak 2001). The step size strategy in this algorithm is based on continuity theorem given in

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(Duman and Aydın 2011). The boundary of the continuity theorem is very sharp. It means that the step sizes are quite large. Moreover, obtained results are supported with numerical examples by using matrix vector calculator MVC (Bulgak and Eminov 2003).

Key Words: Difference equation system, Interval matrix, Schur stability

MSC : 37B25,39A06,65F30,68-00

REFERENCES

[1] S. Elaydi, An introduction to difference equations, Springer Verlag, New York, 1996.

[2] Ö. Akın, H. Bulgak, Linear difference equations and stability theory, Selcuk University, Konya, 1998.

[3] A. Bulgak, Checking a practical discrete-time asymptotic stability of an interval matrix, Selcuk Journal of Applied Mathematics, 2 (2), 11-16, 2001.

[4] A. Bulgak, H. Bulgak, Linear algebra, Selcuk University, Konya, 2001.

[5] H. Bulgak, D. Eminov, Computer dialogue system MVC, Selcuk Journal of Applied Mathematics, 2 (2), 17-38, 2003.

[6] A. Duman, K. Aydın, Sensitivity of Schur stability of systems of linear difference equations with constant coefficients, Scientific Research and Essays, 6(28), 5846-5854, 2011.

Variable step size strategy for numerical solutions of differential equations x'' = f(t,x)

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ABSTRACT

We need to solve some differential equations by numerical methods. Since numerical methods are iterative, they provide great convenience in calculating the solution of Cauchy problems. In order to obtain a numerical solution close enough to the analytical solution of the Cauchy problem, it is necessary to pay attention to the selection of the step size in numerical integration. In the literature about numerical integration, it is seen that fixed step size is generally used. In this case, the selected fixed step size must be too small for obtaining a numerical solution close enough to the analytical solution. However, this selection may require too many calculation operations and a long time. Therefore, it would be more appropriate to select variable step size according to the structure of the problem (Çelik Kızılkan 2004, Çelik Kızılkan and Aydın 2005, Çelik Kızılkan and Aydın 2006, Çelik Kızılkan and Aydın 2011, R. Holsapple et all 2007). For the Cauchy problem

$$x' = f(t,x), x(t_o) = x_0 \, , \tag{1}$$

step size strategies based on Picard theorem and error analysis are given in (Çelik Kızılkan 2004, Çelik Kızılkan and Aydın 2005).

In this study, we have considered the second order Cauchy problem is given in form

$$x'' = f(t,x), x(t_0) = x_0, x'(t_0) = x'_0 \, . \tag{2}$$

Similar to the error analysis in (Çelik Kızılkan and Aydın 2005), we have performed the error analysis of Runge – Kutta - Nyström method given in (Chang and Gnepp 1984) for Cauchy problem (2). We have developed a variable step size strategy for

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numerical integration of Cauchy problem (2) by considering this error analysis. We have also applied the step size strategy based on the Picard Theorem to Cauchy problem (2). Moreover, the results have been supported by numerical examples.

Key Words: Error analysis, Runge-Kutta-Nyström method, Variable stepsize strategy

MSC :34, 65.

REFERENCES

[1] S.H. Chang, P.C. Gnepp, A direct method for the numerical solution of $y'' = f(x,y)$, Calcolo J. Vol: 21 No: 4, 369-377, 1984.

[2] G. Çelik Kızılkan, Step size determination in numerical integration of initial value problems, Master Thesis, Selçuk University, Graduate School of Natural and Applied Sciences, 2004.

[3] G. Çelik Kızılkan, K. Aydın, Error analysis based step size strategy, Selçuk University, Faculty of Science and Arts, Science J., No:25, 79-86, 2005.

[4] G. Çelik Kızılkan, K. Aydın, A new variable step size algorithm for Cauchy problem, Applied Mathematics and Computation, 183, 878-884, 2006.

[5] G. Çelik Kızılkan, K. Aydın, Step Size Strategies Based On Error Analysis For The Linear Systems, SDU Journal of Science (E-Journal), 6 (2): 149-159, 2011.

[6] R. Holsapple, R. Iyer, D. Doman, Variable Step-Size Selection Methods For Implicit Integration Schemes For Odes, International Journal of Numerical Analysis and Modeling, 4(2), 210-240, 2007.

Dwell time for the Hurwitz stability of switched linear differential systems

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ABSTRACT

A switched system is defined as the dynamical system that contains of a finite number of subsystems and switching rules between these subsystems. The switched systems are used in mathematical modeling of many fields such as industry and engineering. Therefore, in recent years interest in studies on the stability of switched systems has increased. One way of the stability analysis in switched systems is to determination of the dwell time. The dwell time is the time elapsed between two consecutive switching events. If each subsystems are stable then it is known existence a minimum dwell time that guarantees stability of the switched system.

Over the past several years, for determining a dwell time and an average dwell time to Hurwitz stabilization of switched systems a lot of study has been done. These studies are generally based on the eigenvalue problem which is an ill conditioned problem for non-symmetric matrices.

In this talk, the graph-dependent linear differential switched systems is considered described by

$$\dot{x}(t) = \boldsymbol{A}_{\sigma(t)}x(t), \sigma \in \mathcal{S}, t \geq 0 \tag{1}$$

where $\{\boldsymbol{A}_p \in \mathbb{C}^{n\times n},\ p \in \mathcal{P}\}$ is matrix family for $\mathcal{P} = \{1,2,\dots,N\}$, $\mathcal{S}$ is the set of the functions $\sigma: [0,\infty) \to \mathcal{P}$, σ denotes the switching signals. And a new method is proposed without calculating the eigenvalue to determine the dwell time and average dwell time. This new method is based on the stability parameter proposed in [1].

Key Words: Hurwitz stability, Switched system, Dwell time, Average dwell time.

MSC:. 34D20, 93D05.

REFERENCES

[1] A. Duman, K. Aydın, Sensitivity of Hurwitz stability of linear differential equation systems with constant coefficients, International Journal of Geometric Methods in Modern Physics, Vol. 14, No. 6, 2017.

[2] Ö. Karabacak, Dwell time and average dwell time methods based on the cycle ratio of the switching graph, Systems & Control Letters, Vol. 62, 2013.

[3] S. Morse, Supervisory control of families of linear set-point conrollers-part 1:exact matching, IEEE Trans. Autom. Control, Vol. 41, 1996.

[4] J.C. Geromel, P. Colaneri, Stability and stabilization of continuous-time switched linear systems, SIAM J. Control Optim. Vol. 45, 2006.

APPLIED

SCIENCES

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Examination of a two parameter estimator with mathematical programming method

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ABSTRACT

Least squares estimator has some drawbacks and it is no longer favorable when the problem of multicollinearity is encountered in linear regression model. We propose a new two parameter estimator with attempt to have a more efficient estimator to deal with the problem of multicollinearity. A mathematical programming approach is utilized to specify two biasing parameters simultaneously by following the way of Ebaid et al. (2017). Since the mean square error and the length of an estimator are usually large in the existence of multicollinearity, we achieve to minimize both of them at the same time with this programming method. Therefore, by using this approach, the biasing parameters are determined by minimizing the mean square error under the constraint that the length of the newly defined two parameter estimator is less than the length of the least squares estimator. As an alternative interpretation of this approach, the biasing parameters are estimated simultaneously to minimize the mean square error according to the constraint that the length of the newly defined two parameter estimator is less than the length of the Liu estimator defined by Liu (1993). In addition to these new selection methods, we theoretically derive optimal biasing parameters by minimizing the mean square error. Consequently, via a numerical example, the mathematical programming parameter estimations and the theoretical optimal parameter estimations are computed. With the help of these biasing parameter estimations, the mean square errors and the lengths of the mentioned estimators are calculated for comparison.

Key Words: Mathematical programming, multicollinearity, two parameter estimator.

MSC: 62, 65, 90.

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REFERENCES

[1] R. Ebaid, R. Farghali, S. Abo-El-Hadid, A Mathematical Programming Approach for Liu-type Estimator, Advances and Applications in Statistics 50 (4) (2017) 293-314.

[2] A.E. Hoerl, R.W. Kennard, Ridge Regression: Biased Estimation for Nonorthogonal Problems, Technometrics 12 (1) (1970) 55-67.

[3] B.M.G. Kibria, Performance of Some New Ridge Regression Estimators, Communications in Statistics-Simulation and Computation 32 (2) (2003) 419–435.

[4] J.F. Lawless, P.A. Wang, Simulation Study of Ridge and other Regression Estimators, Communications in Statistics-Theory and Methods 5 (4) (1976) 307-323.

[5] K. Liu, A New Class of Biased Estimate in Linear Regression, Communications in Statistics-Theory and Methods 22 (1993) 393-402.

A design of fuzzy logic-based attitude determination system

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ABSTRACT

Fuzzy logic is an artificial intelligence technique [1]. The most prominent feature of fuzzy logic is that it is more flexible than classical logic and can make more accurate evaluation[2]. Unlike classical logic, fuzzy logic has membership degrees which helps to determine membership degree of an element to a cluster and provides results that are closer to reality in uncertain situations [3].

In this study, an attitude determination system has been developed by using fuzzy logic method. The attitude scale used in this study was developed to measure the attitude of undergraduate students towards mobile learning. The scale is consist of 4 factors and 45 items [4]. Each factor of the scale is considered as an input value of the developed fuzzy system. These input values are fuzzied by using triangular membership functions in the designed fuzzy logic-based system. In order to make inference, the developed system uses rule base which has been created by using Mamdani method based on "IF THEN" rules.

The rule base of the study is consist of 327 rules which are prepared in accordance with the experts opinion. A fuzzy result was obtained by executing the rule base on input values. This result needs to be clarified and transformed into a numerical value. In the study, "Centroid of Area (CoA)" method was used as the defuzzification method.

Measuring attitude which is a psychological variable is more difficult than measuring physical variables [5]. Fuzzy Logic helps to resolve uncertain situations where information is not definite [6]. Therefore, it is inevitable to use fuzzy logic approach in areas that involve complex processes. The proposed fuzzy logic-based system was aimed to evaluate the attitude scale more precisely and accurately than the classical method. This is the first study in this field that there is no similar study in

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literature to be compared with. Hence, success rate of the application is planned to be presented by making comparisons with classical approach in the future studies.

Key Words: Fuzzy logic, attitude

REFERENCES

[1] S. Isıklı, "Fuzzy Logic and Fuzzy Technologies" Ankara University, Faculty of Language, History and Geography Journal of Anthropology, vol. 0, no. 19, 2008.

[2] I. B. Turksen, "Fuzzy Sets and Systems and its Applications in Production Research," in Toward the Factory of the Future, Berlin, Heidelberg: Springer Berlin Heidelberg, 1985, pp. 649–656.

[3] M. Sari, Y. S. Murat, and M. Kirabali, "Fuzzy Logic Modelling Approach and Applications," https://birimler.dpu.edu.tr/app/views/panel/ckfinder/userfiles/16/files/Dergiler/9/09.pdf. [Erisim tarihi: 04.05.2019], vol. 17, no. 3, pp. 3903–3916, 2006.

[4] E. Demir, K., & Akpınar, "Development Of Attitude Scale Towards Mobile Learning," Educational Technology Theory and Practice, vol. 6, no. 1, pp. 59–79, 2016.

[5] A. Erkus, "Writings on Psychometry: Historical background of measurement and psychometry, reliability, validity, item analysis, attitudes," Turkish Psychologists Association, 2003.

[6] L. A. Zadeh, "Fuzzy sets," Inf. Control, vol. 8, no. 3, pp. 338–353, Jun. 1965.

Fibonacci oscillators, Fibonacci calculus and thermo-statistics

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ABSTRACT

In this talk, we first present the deformed quantum algebras constructed by the bosonic and fermionic Fibonacci oscillators [1,2], whose properties enable us to study the main features of the Fibonacci calculus. We then introduce the thermo-statistics of a gas model of these quantum oscillators [3,4]. As an application, the behaviour of the statistical distribution function of the present gas model is analyzed within the framework of continued fractions. It is shown that the entire structure of thermodynamics is preserved if the standard thermodynamical derivatives are replaced by the modified Fibonacci difference operator, which is a two-parameter generalization of the Jackson derivative operator in the q-calculus. Finally, other possible applications of the present approach will be pointed out.

Key Words: Quantum groups, deformed oscillators, q-calculus, thermo-statistics.
MSC: 17, 81, 82.

REFERENCES

[1] A. Algin, M. Arik, A. S. Arikan, Multi-parameter deformed fermionic oscillators, The European Physical Journal C, 25 (2002) 487-491.

[2] M. Arik, E. Demircan, T. Turgut, L. Ekinci, M. Mungan, Fibonacci oscillators, Z. Phys. C: Particles and Fields 55 (1992) 89-95.

[3] A. Algin, M. Arik, M. Senay, G. Topcu, Thermostatistics of bosonic and fermionic Fibonacci oscillators, International Journal of Modern Physics B, 31 (2017) 1650247.

[4] A. Algin, Fibonacci oscillators and two-parameter generalized thermostatistics, Communications in Nonlinear Science and Numerical Simulation, 15 (2010) 1372-1377.

An inverse coefficient problem for quasilinear pseudo-parabolic heat conduction of polymeric materials

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ABSTRACT

The inverse problem of determining unknown coefficient in a quasi-linear parabolic equation has generated an increasing amount of interest from engineers and scientist. The problem of recovering unknown source function in the mathematical model of a physical phenomena is frequently encountered. These problems were studied by many scientists with different boundary conditions (Cannon 1988, Pourgholia 2010, Ford 1973, Li 2015). The problem proposed in this study can be used in many application such as investigation of heat distribution on laser material interaction. In this article, we worked with periodic boundary conditions unlike others. Moreover, from a technical point of view, these boundary conditions are more difficult. This condition was studied by (Baglan 2010,Baglan 2014,Halilov 2009) with different direct problems. Also, in this article, we worked with pseudo-parabolic inverse problem.

Consider the problem of finding a pair of functions (a,u) satisfying the following quasilinear pseudo-parabolic problem:

$$u_t - u_{xx} - \varepsilon u_{xxt} - a(t)u = f(x,t,u) \qquad (1)$$

$$u(x,0) = \varphi(x) \qquad (2)$$

$$\begin{aligned} u(0,t) &= u(\pi,t) \\ u_x(0,t) &= u_x(\pi,t) \end{aligned} \qquad (3)$$

$$E(t) = \int_0^{\pi} xu(x,t)dx \qquad (4)$$

for a quasilinear parabolic equation with the nonlinear source term $f = f(x,t,u)$.

In this research, we examine an inverse problem of a quasilinear pseudo-parabolic equation with periodic boundary condition.We consider the initial-boundary

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value problem (1)-(4) with periodic boundary conditions (3) and integral over determination condition (4). In this study, we prove the existence, uniqueness convergence of the weak generalized solution, continuous dependent upon the data of the solution by Fourier method; and we construct an iteration algorithm for the numerical solution of this problem. We analyze computationally convergence of the iteration algorithm, as well as treating a test example.

Key Words: Quasilinear Pseudo-Parabolic Equation, Inverse Problem, Periodic Boundary Condition, Finite Difference Method.

MSC: 35K05, 35K29 , 65M06, 65M12.

REFERENCES

[1] Baglan I., Numerical Solution of a Quasilinear Parabolic Problem with Periodic Boundary Condition, Hacettepe, Journal of Mathematics and Statistics, 2010;39(2):183-189.

[2] Baglan I., Kanca F.,The Continuous Dependence and Numerical Approximation of the Solution of the Quasilinear Pseudo-Parabolic Problem with Periodic Boundary Condition, Journal of Advances in Mathematics, 2014,5(3).

[3] Halilov H., Ciftci I., Fourier Method for a Qusilinear Pseudo-Parabolic Equation with Periodic Boundary Condition, Hacettepe Int. Jour. of Pure and App. Math., 2009, 52, 717-727.

[4] Cannon J,R., Lin Y., Determination of parameter p(t) in Hölder classes for some semilinear parabolic equations. Inverse Problems, 1988, 4, 595-606.

[5] Pourgholia R, Rostamiana M and Emamjome M., A numerical method for solving a nonlinear inverse parabolic problem. Inverse Problems in Science and Engineering, 2010, 18(8), 1151-1164.

[6] Ford W. H. and Ting T. W., Stability and Convergence of Difference Approximations to Pseudo Parabolic Partial Differential Equations,1973,27(124),739-743.

[7] Li Y., Cao Y., Time Periodic Solutions for a Pseudo-parabolic Type Equation with Weakly Nonlinear Periodic Sources, 2015, 38(2), 667–682.

Modeling of temperature distribution as a function of laser energy: Parallel to the fiber axis on poly(ether-ether-ketone) composites

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ABSTRACT

Poly(ether-ether-ketone) (PEEK) is used in many area especially structural and industrial applications due to the fact that it has superior mechanical, chemical and thermal properties [1]. Besides excellent electrical and thermal properties, carbon fibres have high specific tensile modulus and strength [2]. Due to these properties, carbon fibers are frequently used as reinforcement materials in polymer matrices. While the polymer matrix determines the long-term durability of the composite system, light carbon fibers ensure that the material is durable and lightweight. The polymeric matrix also contributes to damage resistance and interlaminar shear strength [3].

Since composites have more than one materials together which are different thermal and mechanical properties, machining of composites is more complex than pure materials. Lasers are used in many industrial and high technological area.

In this study, proposed mathematical model has been applied on the cavity formation on PEEK composite by single laser pulse using Fourier method with homogenous approach. The effects of the laser energy on temperature distribution in PEEK composite was investigated and the numerical model was obtained. Under some natural regularity and consistency conditions on the input data, the existence, uniqueness of solution are shown by using the generalized Fourier method.

Finally, the experimental data are compared to the results calculated by heat conduction models.

Key Words: Mathematical Modelling, Laser Ablation, Fiber, PEEK, Composites, Generalized Fourier method.
MSC: 80.

REFERENCES

[1] P.J. Rae, E.N. Brown, E.B. Orler, The mechanical properties of poly(ether-ether-ketone) (PEEK) with emphasis on the large compressive strain response, Polymer, 48, 598-615, 2007.

[2] J. Sandler, P. Werner, M. S.P. Shaffer, V. Demchuk, V. Altstadt, A.H. Windle, Carbon-nanofibre-reinforced poly(ether ether ketone) composites, Composites: Part A 33, 1033-1039, 2002.

[3] C. N. Velisaris and J. C. Seferis, Heat Transfer Effects on the Processing-Structure Relationships of Polyetheretherketone (Peek) Based Composites, Science and Engineering of Composite Materials, V1, 13-22, 1988.

Analysis of graduate thesis made in Turkey on mobile applications

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ABSTRACT

In this study, it is aimed to analyze and evaluate the master's and doctoral thesis studies on mobile application which are published between the years of 2010-2017. Thus, it has been tried to show the trend of mobile applications on graduate studies in Turkey [1].

For this purpose, all of the thesis with the subject of mobile application in education between the years 2010-2017 are scanned in the database of YÖK National Dissertation Center. In this study, a total of 53 graduate thesis studies, 41 of which are master's thesis and 12 of which were doctoral thesis, are accessed. The master's and doctoral thesis are analyzed in terms of years, universities, institutes, broadcasting language, sampling, application courses and data collection tools [2].

When the distribution of master thesis is examined by years, it has been seen that the most thesis on mobile application in education and training category is published in 2016. When the distribution of doctoral thesis according to years is examined, it has been seen that the highest number of doctoral thesis is published in 2015.

When the distribution of graduate thesis according to universities is examined, it is determined that most of the master thesis is prepared in Gazi University and most doctoral thesis is prepared in Atatürk University. When it is analyzed by the institutes, it has been seen that both master and doctoral thesis are prepared mostly within the Institute of Educational Sciences.

According to the category of publication language, master’s and doctoral thesis are mostly written in Turkish. When graduate thesis are categorized according to sampling, it has been seen that most undergraduate students are selected as samples in both master and doctoral thesis studies.

It is observed that some of the thesis examined within the scope of the study are applied in the courses [3]. When we analysed the distribution according to the applied courses, it is recognized that while English courses are the main subjects in the master thesis, English courses and science courses are the main subjects in the doctoral thesis.

As a result of the analysis, it has been seen that survey and semi-structured interview are mostly preferred as the data collection tool in the master and doctoral thesis. Daily use is the least preferred data collection tool. In addition, it is determined that most of the graduate thesis studies are carried out to examine the effect of mobile applications on success and attitude.

The results obtained within the scope of this study are considered to be a guide for the researchers interested in the subject [4].

Key Words: Mobile game, mobile learning, education.

REFERENCES

[1] Agca, R. K., & Bagci, H. (2013). Student Opinions on the Use of Mobile Tools in Education. Journal of Education and Training Research, 295-302.

[2] Sahin, M., & Barracks, T. (2013). Customizable Learning Environments: Literature Review.

[3] Ongoz, S., Aydin, S., & Aksoy, D. (2016). Graduate Thesis Theme Multimedia Trends Made in the area of Educational Sciences in Turkey. Journal of Instructional Technology & Teacher Training, 5 (1).

[4] Keskin, N. Ö., & Kilinç, A. G. H. (2015). Comparison of Development Platforms for Mobile Learning Applications and Sample Applications. Journal of Open Education Applications and Research, 1 (3), 68-90.

The classical and heuristic algorithms for shortest path problems

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ABSTRACT

Optimization is the process of obtaining the most appropriate solution for a specific purpose and under some constraints given. In mathematical sense, it can be expressed as minimizing or maximizing a function. In an optimization problem, f_i being a function and x_i being a decision variable, objective function is defined as:

$$Max(or\ Min)\, f_o(x_1, x_2, ..., x_n)$$

and constraints are defined as:

$$f_1(x_1, x_2, ..., x_n) <= b_1$$

$$f_k(x_1, x_2, ..., x_n) >= b_k$$

$$f_m(x_1, x_2, ..., x_n) = b_m$$

If all the functions in the problem are linear, they are expressed as linear optimization problems. There are many optimization models within the scope of operations research. The best known of these are linear programming, integer programming, assignment problems, shortest path problems, knapsack problems, budgeting problems and travelling salesman problems.

In this study, one of the optimization problems the shortest path problem is discussed. The shortest path problem aims to find the shortest path between nodes, as in the case of travelling salesman problem. However, it differs from them in two aspects. First, there is no obligation to visit all nodes on the way to the destination. The second is no return to the beginning. Therefore, the shortest path problem does not include a loop. In a problem with k nodes, the shortest path has a maximum of k-1 paths. An exemplary shortest path algorithm is shown graphically in Figure 1.

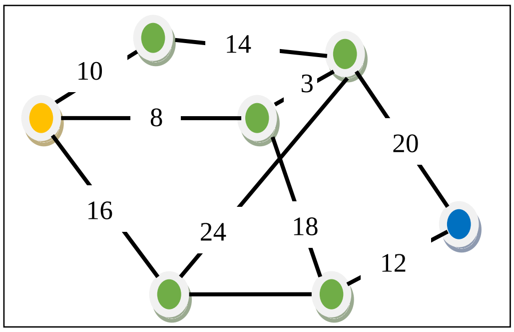

Figure 1. Graph of Shortest Path

Here the yellow node is the starting point and the blue node is the target point. The green nodes represent the routes to be taken.

Classical and heuristic algorithms developed for solving shortest path problems are widely used. In this study, from among the classical algorithms, Dijkstra, Bellman Ford, Johnson algorithms and from among the heuristic algorithms, Genetic, Scaling, Dinitz algorithms were examined.

n is the total number of vertices and m is the total number of edges;

Metods	Classic or Heuristic	Complexity
Dijkstra Algorithm	Classic	$O(n^2)$
Bellman-Ford Algorithm	Classic	$O(n^3)$
Johnson Algorithm	Classic	$O(m\log_{(2+m)/n} n)$
Genetic Algorithm	Heuristic	O(nlogn)
Scaling Algorithm	Heuristic	$O(\sqrt{n}m\log n)$
Dinitz (or Dinic's) Algorithm	Heuristic	O(m+n(U/delta))

In this context, the complexities of the algorithms were investigated and comparisons were made.

Key Words: Optimization, shortest path problems, classic and heuristic algorithms.

MSC: 62, 90.

REFERENCES

[1] L. Taccari, Integer Programming Formulations for the Elementary Shortest Path Problem, European Journal of Operational Research, 2016.

[2] A. Madkour, W.G.Aref, F.U. Rehman, M.A. Rahman, S. Basalamah, A Survey of Shortest-Path Algorithms, arXiv:1705.02044, 2017.

[3] S. Broumi, A. Bakali, M. Talea, F. Smarandache, L. Vladareanu, Applying Dijkstra Algorithm for Solving Neutrosophic Shortest Path Problem, Proceedings of the 2016 International Conference on Advanced Mechatronic Systems, Melbourne, Australia, 2016.

[4] B.V. Cherkassky, L. Georgiadis, A.V. Goldberg, R.E. Tarjan, R.F. Werneck, Shortest Path Feasibility Algorithms: An Experimental Evaluation, Journal of Experimental Algorithmics, 2009.

[5] F. Uçan, G.B. Kaplan, R. Çaputçu, M. Haklıdır, Ö.F.Arar, Taktiksel En Kısa Yol Problemlerinin Genetik Algoritma Yaklaşımı ile Çözümü, Ulusal Savunma Uygulamaları Modelleme ve Simülasyon Konferansı, 2007.

[6] C.G. Şen, Modellemeye Giriş Ders Notları, http://www.yildiz.edu.tr/~cgungor/modellemeyegiris/acrobats/Ders%206_11.11.pdf, 2011.

[7] Z. Cömert, En Kısa Yol Problemi, www.zafercomert.com, Veri Yapıları ve Algoritmalar 2015.

[8] N. Azgınoğlu, Johnson Algoritması–En Kısa Yol Problemi (The Shortest Path Problem), http://www.nuhazginoglu.com/category/veri-yapilari-ve-algoritmalar/, 2019.

Double Kamal transform method and its application for solving telegraph equation

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ABSTRACT

The theory and application of ordinary and partial differential equations play an important role in the modelling of most of the physical phenomena, biological models, engineering sciences, real life problems.

There are so many different techniques to solve differential equations. Integral transform techniques such as Laplace, Fourier, etc. are extensively applied in theory and application [1,3]. Kamal transform, which is also an integral transform, is derived from the classical Fourier integral. This transform is one of the very convenient mathematical tools for solving differential equations. The definition, properties and applications of the Kamal transform to ordinary differential equations were described [2].

In recent years, many various methods such as double Laplace transform, double Sumudu transform introduced by many researchers to find the solution of partial differential equations.

In this study, we derive the formulae, for the first time, for the double Kamal transform [4]. In order to show the applicability and efficiency of the double Kamal transform, we obtain the exact solution of general linear telegraph equation which appear in the propagation of electrical signals along a telegraph line, digital image processing, telecommunication, signals and systems. In order to illustrate the ability of the method, an example is provided [4].

Acknowledgement: This study is a part of the first author's M.Sc. Thesis.

Key Words: Kamal Transform, Double Kamal Transform, Telegraph Equation

MSC: 35, 44

REFERENCES

[1] A. K. H. Sedeeg, Z. I. A. Mahamoud, The Use of Kamal Transform for Solving Partial Differential Equations, Advances in Theoretical and Applied Mathematics, Vol.12, 7-13, 2017.

[2] A. Kamal, H. Sedeeg, The New Integral Transform “Kamal Transform”, Advances in Theoretical and Applied Mathematics, Vol.11, 451-458, 2016.

[3] L. Debnath, D. Bhatta, Integral Transforms and Their Applications, Second Edition, Chapman and Hall/CRC, Boca Raton, Florida, USA, 2006.

[4] F. Tezcan, M.Sc. Thesis, Selcuk University (to appear).

Type I generalized half logistic lindley distribution and its some properties

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ABSTRACT

In this study, a new statistical distribution called as type I generalized half logistic lindley (TIGHL) distribution is introduced. This new distribution is obtained by finding distribution of maximum of a X random variable having Lindley distribution with a Y random variable having Type I Generalized Half Logistic distribution introduced by Olapade (2014). Some statistical properties such as moments, coefficients of skewness and kurtosis for this new distribution having increasing failure rate are examined. Maximum likelihood estimation method for estimation of the parameters of this new distribution is used. A Monte Carlo simulation study based on performances of Maximum Likelihood (ML) estimators according to mean square error (MSE) and bias is performed. Finally, using real data, this new distribution are compared with other known distributions in terms of goodness of fit measures such as log-likelihood, Akaiki information criteria, Bayesian information criteria.

Key Words: Maximum likelihood estimation, Monte Carlo simulation, type I generalized half logistic lindley Distribution.

MSC: 62F10, 62E15.

REFERENCES

[1] A. Asgharzadeh, S. Nadarajah, F. Sharafi, Weibull Lindley distribution. Revstat, 16, 87-113, 2018.

[2] A. K. Olapade, The type I generalized half logistic distribution. Journal of the Iranian Statistical Society 13 1 69-82, 2014.

[3] N. Balakrishnan, M. Y. Leung, Order statistics from the Type I generalized Logistic Distribution. Communications in Statistics - Simulation and Computation, 17(1), 25-50, 1988.

Outlier detection methods for univariate circular datasets

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ABSTRACT

Circular (directional) statistics is a method used mainly in engineering, meteorology, ocean science, geography, geology, medicine, neuroscience, and it is related to directions, angles and rotations. In traditional statistical methods, the data are assumed to be on the real number line, whereas in the circular statistics the data consist of angles which are measured on a given reference point and are assumed to be on the unit circle. The concept of outliers in statistics is used for the observations that have different behaviors and have a significant distance from other observations in a random selected sample from a population. The existence of outliers is one of the most important problems that encountered in modelling and forecasting process. Due to the fact that the circular data structure is different from the linear data, it is also necessary to have a special examination in the case of this type of observation. In this study, outlier detection methods are examined and a robust nonparametric procedure is proposed for detection of outliers in a circular univariate dataset. The performance of the proposed method is investigated with a comprehensive simulation study and real data applications. Results are compared with existing methods. It has been observed that the proposed method has high performance in detection of outliers.

Key Words: Circular data, outlier detection, robust methods
MSC: 62

REFERENCES

[1] A. H. Abuzaid, Some problems of outliers in circular data, Doctoral dissertation, University of Malaya, 2010.
[2] E. A. Mahmood, S. Rana, H. Midi, A. G., Hussin, Detection of Outliers in Univariate Circular Data using Robust Circular Distance. Journal of Modern Applied Statistical Methods, 16(2), 22, 2017.
[3] I. B.Mohamed, A. D. Z. H. A. R. Rambli, N. U. R. L. I. Z. A. Khaliddin, A. I. N. Ibrahim, A new discordancy test in circular data using spacings theory. Communications in Statistics-Simulation and Computation, 45(8), 2904-2916, 2016.

A new mutation approach for particle swarm optimization

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ABSTRACT

Global optimization methods are widely used for obtaining more sensitive results including minimizing the related errors in mathematical problems. Particle Swarm Optimization (PSO), a population based global optimization approach introduced by Eberhart and Kennedy, inspired social behaviour of birds and fishes. The algorithm is extended by many researches for its easy implementation.

In the present work, we improved original PSO algorithm via defining a new mutation operator based on dynamically generated hyper-ellipsoids to support the adaptive swarm size mentality. In each iteration of the proposed method, a new population is generated inside of the hyper-ellipsoid constructed randomly in the neighbourhood of the best optimal solution found so far. If an individual of the swarm has better fitness value than the global best, which is the best solution found so far, it is labelled as the new global best. Thus improves the capability of PSO by means of exploitation.

Furthermore, to increase the exploration ability of classical PSO, a randomly generated population outside of the hyper-ellipsoid is also used and it is investigated whether the better solution is. In this way, the dynamically creation of hyper-ellipsoids help us generating new particle population.

We use some popular benchmark functions to test performance of the proposed approach within both of low and high dimensional cases. We compare the performance of the proposed approach with original PSO. The obtained results show that the proposed approach could improve the performance of original PSO. Our suggestion could be easily applied to other population based optimization techniques for solving daily life problems requiring optimization.

Key Words: Metaheuristic, swarm intelligence, particle swarm optimization, global optimization, hyper-ellipsoid.

MSC: 49, 68.

REFERENCES

[1] J. Kennedy, R.C. Eberhart, Particle swarm optimization. In: Proceedings of the IEEE International Conference on Neural Networks. pp. 1942–1948, 1995.

[2] J. Deaert and C. Musso. (2001). An Efficient, Method for Generation Points Uniformly Distributed in Hyper-ellipsoids, Proc. of the Workshop on Estimation, Tracking and Fusion: A Tribute to Yaakov Bar-Shalom, Monterey, California, 2001.

[3] M. Jamil and X.S. Yang. A literature survey of benchmark functions for global optimization problems, Int. Journal of Mathematical Modelling and Numerical Optimisation, Vol. 4, No. 2, pp. 150—194, 2013.

A mathematical model for electromagnetic fields around high voltage lines

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ABSTRACT

Magnetic pollution plays an important role in the developing world. World-renowned organizations such as ICNIRP, WHO and IARC have determined limit values for exposure to Electromagnetic Fields (EMF). However, some countries have adopted the values of these organizations as exposure limit values for EMF, while others have established their own exposure limit values. In Turkey, the limit values determined by these institutions have been adopted.

There are many studies in the literature about negative effects of EMF on living things and environment, caused by High Voltage Lines (HVL) [1]. Therefore, it is important to know the values of EMF in the vicinity of an HVL in order to avoid the negative effects of the EMF and to determine safe zones.

In this study, EMF values of 75 measurement points from each 154 kV, and 380 kV HVLs were taken in Elmadağ district of Ankara. By using these values normal distribution graphs were drawn. Graphs are important for parametric tests as in our case it show whether the normal distribution assumption is fulfilled or not. Curve fitting models, (i.e. least square method, Gaussian method, Fourier method) suitable for the data structure were selected by considering the normal distribution of the obtained data.

With the measurement data obtained, curve estimation was performed by using least square method [2-3], Gauss [4-5] and Fourier [6] methods. Then, these curve estimations were compared. For this study, the most appropriate estimation method was obtained, and an appropriate mathematical model was developed to find the EMA values around YGH. Thus, EMA values can be found approximately at any point in the region where YGH is located.

Key Words: Least squares method, Gaussian method, Fourier method, Mathematical model, Electromagnetic field.

MSC: 78.

REFERENCES

[1] Seyhan, N. Elektromanyetik Kirlilik ve Sagligimiz/Electromagnetic Pollution and Our Health. Noro-Psikyatri Arsivi, 47(2), 158, 2010.

[2] Şahinler, Suat. "En küçük kareler yöntemi ile doğrusal regresyon modeli oluşturmanın temel prensipleri." Mustafa Kemal Üniversitesi Ziraat Fakültesi Dergisi 5.1-2, 57-73, 2000.

[3] Arzu, A. R. I.; Onder, Hasan. Farklı Veri Yapılarında Kullanılabilecek Regresyon Yöntemleri. Anadolu Tarım Bilimleri Dergisi, 28.3: 168-174, 2013.

[4] Zheng, Hongqing; Zhou, Yongquan. A novel cuckoo search optimization algorithm based on Gauss distribution. Journal of Computational Information Systems, 8.10: 4193-4200,2012.

[5] RASMUSSEN, Carl Edward. Gaussian processes in machine learning. In: Summer School on Machine Learning. Springer, Berlin, Heidelberg, p. 63-71, 2003.

[6] NAS, Engin; Samtaş, Gürcan; Demır, Halil. CNC Frezelemede Yüzey Pürüzlülüğüne Etki Eden Parametrelerin Matematiksel Olarak Modellenmesi. Pamukkale Üniversitesi Mühendislik Bilimleri Dergisi, 18.1: 47-59, 2012.

Application of metaheuristic methods for portfolio optimization problem

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ABSTRACT

The portfolio is the name given to all financial assets such as cash, currency, gold, stocks, etc. that an investor holds in order to invest and gain profits. Portfolio selection is the process of determining the investment tools to be taken and removed in the created portfolio. The mean-variance model proposed by Markowitz (1952), which is one of the commonly used models in portfolio selection, is based on the acquisition of minimum risk and maximum profits with securities in the portfolio. In recent years, it is observed that metaheuristic algorithms are commonly used to solve portfolio selection problems, instead of classical optimization techniques.

In this study, the data set is obtained by taking the daily closing prices of 30 assets in the BIST30 index between December 2016 – December 2017. Markowitz mean-variance model is considered for portfolio selection. Differential Evolution (DE) and Particle Swarm Optimization (PSO) which are well-known are metaheuristic methods, are applied to determine which portfolios are to be selected. In addition, the performances of these metaheuristic methods have been compared in terms of achieving optimum portfolio.

Key Words: Portfolio Optimization, Metaheuristic methods, Markowitz mean-variance model

MSC : 62,68,90.

REFERENCES

[1] H. Markowitz, Portfolio Selection The Journal of Finance, Vol. 7, No. 1. (Mar., 1952), pp. 77-91.

[2] R. Storn, K. Price, A simple and Efficient Heuristic for Global Optimization over Continuous Spaces, Journal of Global Optimization 11: 341–359, 1997.

[3] R. Eberhart, J. Kennedy, A New Optimizer Using Particle Swarm Theory, MHS'95. Proceedings of the Sixth International Symposium on Micro Machine and Human Science, IEEE, 1995.

[4] R. Armananzas, J.A. Lozano, A multiobjective approach to the portfolio optimization problem, IEEE Congress on Evolutionary Computation, 2005.

[5] N. Bacanin, M. Tuba, Fireworks algorithm applied to constrained portfolio optimization problem, 2015 IEEE Congress on evolutionary computation (CEC). IEEE, 2015.

[6] F. Busetti, Metaheuristic approaches to realistic portfolio optimization, arXiv preprint cond-mat/0501057,(2005).

Investigation of demand power for ÇANKIRI

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ABSTRACT

Due to technological developments, the need for electrical energy is changing day by day. This needs to be taken into account in the design and planning of houses or facilities. Today, electrical installations are made in accordance with the Electrical Internal Facilities Regulation [1]. Demand power is created by taking into account the installed power and necessary calculations are made accordingly [2]. Installed power is expressed as the sum of the rated (label) powers of electrical consumers in a plant [3]. Here, the installed power values are the values determined as a prediction [4-5]. Demand power is a value obtained by multiplying the concurrency coefficient by considering the installed power and most of the calculations in the plant are made according to this value. Costs of materials calculated according to demand power also change according to these values [6]. However, plants often do not operate on demand. This is a situation that needs to be considered and evaluated. Therefore, in this study, the demand power and the maximum power value used by the subscribers in Çankırı in 2018 were examined [7]. In 2018, the number of low-voltage subscribers in Çankırı is 2534 and these consumers constitute 906 buildings. In this study, the installed power, demand power and maximum power value of 2534 data are examined. The numerical analysis of the data was carried out as a result of the equations in Equation 1 and Equation 2, which determined the ratio of demand and maximum power to installed power in%.

$$\%DiversityFactor = \frac{P_{demand}}{P_{installed}} * 100 \qquad (1)$$

$$\%DiversityFactor\_new = \frac{P_{\max}}{P_{installed}} * 100 \qquad (2)$$

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When the results obtained from Equation 1 and Equation 2 are examined for all data, it is seen that there are differences between the data by 40% and this situation should be reevaluated with constant multiplier value expressed as the coefficient of concurrence. In addition, when the data of 2534 buildings in Çankırı were examined and analyzed, it was seen that 90% of them did not draw as much energy as demand power. In addition, in the optimization studies, the distributions of% values calculated by statistical methods considering maximum power value were determined in graphs.

MSC : 49, 65, 93.

Key Words: Installed power, demand power, simultaneous power, electrical internal installation project, optimization, correlation

REFERENCES

[1] TMMOB ELECTRICAL ENGINEERS ROOM, Electrical Internal Facilities Regulation. ANKARA, 1954.

[2] Huda, AS Nazmul, et al. "A semi-automatic approach for thermographic inspection of electrical installations within buildings." Energy and Buildings 55 (2012): 585-591.

[3] Saiz, A., J. F. Urchueguía, and J. Martos. "A cellular automaton based model simulating HVAC fluid and heat transport in a building. Modeling approach and comparison with experimental results." Energy and Buildings 42.9 (2010): 1536-1542.

[4] Hanna, Awad S., Pehr Peterson, and Min-Jae Lee. "Benchmarking productivity indicators for electrical/mechanical projects." Journal of construction engineering and management128.4 (2002): 331-337. https://ascelibrary.org/doi/abs/10.1061/(ASCE)0733-9364(2002)128:4(331)

[5] Chan, Albert PC, David Scott, and Edmond WM Lam. "Framework of success criteria for design/build projects." Journal of management in engineering 18.3 (2002): 120-128.Regulation of electrical internal facilities

[6] Tronchin, Lamberto, and Kristian Fabbri. "Energy performance building evaluation in Mediterranean countries: Comparison between software simulations and operating rating simulation." Energy and buildings 40.7 (2008): 1176-1187.

[7] Baskent Electricity Distribution company data.

Mathematical modelling in image processing for quality control of rigid plastic food packaging manufacturing process

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ABSTRACT

As one of the measurement criteria of the level of development, the quality of packaging is increasing day by day in the world where the amount of packaging consumption per person is increasing day by day. The increase in quality has brought the hygiene level to the next level. In this context, increasing the hygiene level has been included in the performance criteria of the packaging manufacturers. The most basic improvement method of hygiene level in the industry is the production methods without touching. The first stage of untouched production is now carried out untouched by many packaging companies, while the second stage of quality control still includes question marks.

In this study, quality control of plastic packages by image processing method will be examined. In this way, it is aimed to increase the hygiene and quality standards to the upper levels by performing quality control process without touching, which is the second stage of production without touching. The images taken from the camera will be mathematically modelled and uploaded to the computer system. The mathematical model for the image processing of the reference product will be created as in literatures [1-7]. Rigid plastic food packages produced on high speed injection machines are controlled by image processing system and compared with reference product. The images transferred to the system with the help of the cameras in the image processing system are modelled and identified. The capture of the photo, its storage in the buffer and its processing processes must be defined separately. Image transfer time is 10-35 millisecond and image processing time is 120-300 millisecond depending on the filter and mathematical model to be applied.

Key Words: Image processing, Mathematical modelling, Quality control, Rigid plastic food packaging
MSC: 68, 70, 90, 93

REFERENCES

[1] A.K. Jain, Advances in mathematical models for image processing, Proceedings of the IEEE, volume 69, issue 5, Pages: 502 – 528, 1981.

[2] Edward Dougherty, Mathematical Morphology in Image Processing, Boca Raton, ISBN 9781315214610, 3 October 2018.

[3] Chen Kan, Ruimin Chen, Hui Yang, Image-guided Quality Control of Biomanufacturing Process, Procedia CIRP, Volume 65, Pages 168-174, 2017.

[4] Chenang Liu, Andrew Chung Chee Law, David Roberson, Zhenyu (James) Kong, Image analysis-based closed loop quality control for additive manufacturing with fused filament fabrication, Journal of Manufacturing Systems, Volume 51, Pages 75-86, April 2019.

[5] Kemal Adem, Umut Orhan, Mahmut Hekim, Image processing based quality control of the impermeable seams in multilayered aseptic packages, Expert Systems with Applications, Volume 42, Issue 7, Pages 3785-3789, 1 May 2015.

[6] Xue Chen, Lanyong Zhang, Tong Liu, M. M. Kamruzzaman, Research on Deep Learning in the Field of Mechanical Equipment Fault Diagnosis Image Quality, Journal of Visual Communication and Image Representation, In press, accepted manuscript, Available online 19 June 2019.

[7] A. R. Iskhakov, Mathematical Methods of Modeling Of Image Processing And Analysis In The Modified Descriptive Algebras Of Images, Engineering Mathematics, vol. 3, no. 1, pages 3-9, 2016.

Investigation of factoring methods through simulation in factor analysis

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ABSTRACT

Factor Analysis (FA) are widely used in almost all area of the data science. It is used to dimension reduction, variables selection, ranking subjects and etc. In this study, factor analyses are investigated under the light of R library “psych”. This library contains a lot of commands related to FA. One of the biggest important aims of FA is of estimate the factor loadings. There are eight factoring methods (fm) are used in library “psych”. Factor loadings are calculated by fm such as "minres", "uls", "ols", "wls", "gls", "ml", fm="pa", "minchi" and "old.min". These methods can be found in (Johnson and Wichern 2002, Jöreskog 1963, Lawley and Maxwell 1971).

Our main aim of the study is to compare the eight methods discussed above via simulation in terms of bias and mean square errors. In the simulation study, different correlation matrix structures, rotation methods and various sample sizes are considered when the underlying distribution of data is multivariate normal. Furthermore, non-normal data are also examined in the analysis.

There are several tests on the number of factors in the factor analysis. The command “factanal” in library “factanal” gives the chi-squares statistic with p value. In the study, the secondary problem is of predict the power of this test on the number of factors.

Determination of the number of factors is another problem in factor analysis. This can be done by using command “fa.parallel” in library {psych} or Kaiser Criterion (eigenvalue greater than one). The last issue on the study is to simulate the true prediction rate of the Parallel Analysis and Kaiser Criterion methods which determine the number of factors.

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Finally, all experiences obtained from the simulation study are shared with the reader such as which methods are used to estimate the factor loadings and which method is used to predict the number of factors under certain conditions.

Key Words: Factor analysis, factor loadings, Monte Carlo simulation, mean squares errors

MSC : 62, 65

REFERENCES

[1] Johnson, R.A. and Wichern D.W, Applied multivariate statistical analysis, Upper Saddle River, NJ: Prentice hall, 5(8), 2002.

[2] Jöreskog, K.G, Statistical Estimation in Factor Analysis, Almqvist and Wicksell, 1963.

[3] Lawley, D.N. and Maxwell A.E, Factor Analysis as a Statistical Method, Second Edition, Butterworths, 1971.

A comparative study on the tests for repeated measured data

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ABSTRACT

There are many statistical tests in the literature to compare the treatments based on repeated measured data. These tests are categorized in two parts as parametric and non-parametric. The most common parametric tests are repeated measure of ANOVA and Hotelling's T-square, and the non-parametric tests are Friedman (Pereira et all 2015), Kendall W and Cochran Q (Bagdonavicius et all 2011, Corder and Foreman 2009).

In this study, an extensive simulation study is performed. R language is used for the Monte Carlo simulation analysis and 5000 trials are run in each computation. The data are generated from continuous and discrete distributions such as normal, Gamma, Weibull, t, binomial, Poisson, multinomial and etc. The tests are compared in terms of power under different correlation structure and different sample size. Furthermore, it is examined how the null distribution of tests statistics works under different conditions.

According to simulation study, statistical software users will be advised on which test is appropriate to analysis their data. A SWOT analysis is also provided for the considered tests. That is, the efficiency and deficiency of tests are highlighted in case of violation of test assumptions.

A numerical example is also provided to demonstrate how to analyze the repeated measured data.

Key Words: Repeated measured data, Monte-Carlo simulation, Power of hypothesis test, Parametric tests, Non-parametric tests.

MSC : 62, 65.

REFERENCES

[1] V. Bagdonavicius, J. Kruopis, M.S. Nikulin, Non-parametric Tests for Complete Data, John Wiley & Sons. Inc. 111 River, Street Hoboken, NJ, USA, 2011.

[2] G.W. Corder and D.I. Foreman, Nonparametric Statistics for Non-Statisticians: A Step-by-Step Approach, A John Wiley & Sons, Inc. Hoboken, NJ, 2009.

[3] D.G. Pereira, A. Afonso, F.M. Medeiros, Overview of Friedman's Test and Post-hoc Analysis, Communications in Statistics – Simulation and Computation, 44(10), 2015, 2636 – 2653.

Forecasting bank deposits rate: application of arima and moving average models

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ABSTRACT

Banks Foundation is based on attracting deposits where forecasting them is an important issue for banks. Forecasting based on historical data has a great attention nowadays where there are several techniques have been developed in order to get accurate forecasts. Well-known used method for finding an accurate forecasting model for time series based on autoregressive (AR), moving average (MA), autoregressive moving average (ARMA) and autoregressive integrated moving average (ARIMA) models is called Box and Jenkins method. Many studies about Moving Average and ARIMA models were discussed in order to find accurate forecasting models. In this study, an application of ARIMA and Moving Average Models for Forecasting Bank Deposits Rate will be investigated. As it's observed nowadays, banking industry is faced with great competition. The number of banks and use of new tools especially electronic banking have maximized this competition and turned intelligent management of banks into a critical issue. This study seeks to forecast the bank deposits. To do this, we have used the ARIMA method as well as the Moving Average Models. The quarterly data of bank will be used in this study for 16 year period. This study examined the hypothesis that Moving Average with ARIMA models are more accurate than the classical ARIMA models in forecasting the bank deposits.

Key Words: ARIMA models, forecasting, moving average models

MSC : 62.

REFERENCES

[1] Cryer, J. and Chan, K. (2008). Time Series Analysis with Applications in R. Springer, New York.

[2] Dawoud, I and Kaciranlar, S. (2017a). An optimal k of kth MA-ARIMA models under a class of ARIMA model, Communications in Statistics - Theory and Methods, 46:12, 5754-5765.

[3] Dawoud, I and Kaciranlar, S. (2017b). An optimal k of kth MA-ARIMA models under AR(p) models, Communications in Statistics - Simulation and Computation, 46:4, 2842-2864.

[4] Dawoud, I and Kaciranlar, S. (2017c). An optimal k of kth MA-ARIMA models under MA(q) models, Communications in Statistics - Simulation and Computation, 46:6, 4185-4198.

[5] Safi S. and Dawoud, I. (2013). Comparative Study on Forecasting Accuracy among Moving Average Models with Simulation and PALTEL Stock Market Data in Palestine. International Journal of Theoretical and Applied Statistics, 2(6), 202-209.

[6] Shih, S. and Tsokos, C. (2008). A weighted Moving Average Process for Forecasting. Journal of Modern Applied Statistical Methods, 7, 1, 187-197.

[7] Tsokos, C. (2010). K-th Moving, Weighted and Exponential Moving Average for Time Series Forecasting Models. European Journal of Pure and Applied Mathematics, 3, 3, 406-416.

Data envelopment analysis and efficiency analysis of higher education institutions: Example of Selçuk University

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ABSTRACT

The Ministry of National Education and the Council of Higher Education are authorized and responsible for studies on improving the educational quality of higher education institutions in our country, implementation of educational activities, balanced distribution of higher education services throughout the country, to take measures to ensure equality of opportunities and opportunities for candidates to access to higher education through effective and efficient use. The fact that universities are decision-makers, have independent legal entities, and act independently in decision-making and implementation; lack of a foresight mechanism for the decisions to be taken, with the usefulness of the actions taken, and the appropriateness of the decisions taken; act independently in decision-making raises the problem of lack of knowledge of the activities of universities and units. In this study, it was tried to determine how effective and efficient they work with input (number of academic staff, number of administrative staff, number of students, amount of appropriation, etc.) and output (number of graduates, expenditure amount, academic incentive points, etc.) values used by Selçuk University affiliated faculties and four year college. It is important to inform senior management about the current situation and to create insight in decisions to be taken under variable factors for the future. In this study, Selçuk University 2018 Administration Annual Report and 2018 Academic Incentive Score data were used. In this study, data envelopment analysis, which is a parameterless technique which uses linear programming principles, is used to perform relative efficiency analysis in order to enable comparison with each other. As a result of the study, relative efficiency analysis of the units were performed and evaluations were made regarding the ways in which the input and output values

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were not effective and the ways to be effective. If it is effective, in order to maintain the current level of activity, if the idle (unutilized capacity) capacity arose, the assessments regarding the idle capacity were made.

Key Words: Activity Measurement, Universities, Data Envelopment Analysis, Linear Programming
MCS: 61, 65, 68

REFERENCES

[1] Akal, Z. (2011). Işletmelerde Performans Ölçüm ve Denetimi. Ankara, Türkiye: Milli Prodüktivite Merkezi Yayınları No: 473.

[2] Babacan, A., Kartal, M., & Bircan, H. (2007). Cumhuriyet Üniversitesinin Etkinliğinin Kamu Üniversiteleri ile Karşılaştırılması: Bir VZA Tekniği Uygulaması. *Cumhuriyet Üniversitesi İktisadi ve Idari Bilimler Fakültesi Dergisi*, 8(2), 97-114.

[3] Bakırcı, F., & Babacan, A. (2010). İktisadi ve İdari Bilimler Fakültelerinde Ekonomik Etkinlik. *Atatürk Üniversitesi İktisadi ve İdari Bilimler Dergisi, 24*(2), 215-234.

[4] Bal, V. (2013). Vakıf Üniversitelerinde Veri Zarflama Analizi İle Etkinlik Belirlenmesi. *Manas Sosyal Araştırmalar Dergisi, 2*(1), 1-20.

[5] Çınar, Y. (2013). Türkiye'de Kamu Üniversitelerinin Eğitim-Araştırma Etkinlikleri ve Etkinlik Artışında Stratejik Önceliklerin Rolü: Çok Aktiviteli VZA Uygulaması. *Ankara Üniversitesi Siyasal Bilgiler Fakültesi Dergisi, 68(2),* 27-62. 2019 tarihinde alındı.

[6] Ergülen, A., Kazan, H., & Harmankaya, İ. (2016, Ekim). Türkiye'de 1992'de Kurulan Devlet Üniversitelerinin, Veri Zarflama Analizi Yöntemiyle, Performans Değerlendirmesi: Coğrafi Bölge Uygulaması. *Avrasya Bilimler Akademisi İşletme ve İktisat Dergisi*(2), 666-676.

[7] Kutlar, A., & Bakırcı, F. (2018). *Veri Zarflama Analizi Teori ve Uygulama DEA-Solver Win4DEAP Malmquist Endeksi .* Ankara, Türkiye: Orion Kitabevi.

[8] Savaş, F. (2015). Veri Zarflama Analizi. B. F. Yıldırım, & E. Önder içinde, *Operasyonel, Yönetsel, ve Stratejik Problemlerin Çözümünde Çok Kriterli Karar Verme Yöntemleri* (s. 201-227). Bursa, Türkiye: Dora Basım Yayın Dağıtım.

Minimal linear codes and their secret sharing schemes

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ABSTRACT

Linear codes have diverse applications in secret sharing schemes, authentication codes, communication, data storage devices, consumer electronics, association schemes, strongly regular graphs and secure two-party computation. Indeed, as a special class of linear codes, minimal codes have significant applications in secret sharing and secure two-party computation. There are several methods to construct linear codes, one of which is based on functions over finite fields [2]. Recently, many construction methods of linear codes based on functions have been proposed in the literature [2,4].

In this work, to construct minimal linear codes over finite fields, we make use of weakly regular plateaued unbalanced functions defined in [3] in the well-known construction method based on the second generic construction proposed in [2].

We first construct several classes of linear codes with three weights from weakly regular plateaued functions and determine their weight distributions. We next give punctured version of each constructed codes, which may be (almost) optimal codes. Furthermore, in view of a sufficient condition on minimal codes given in [1], we observe that the constructed codes in this work are minimal, which can be directly employed to construct secret sharing schemes with high democracy. We finally describe the access structures of the secret sharing schemes based on the dual codes of the constructed minimal codes. Such secret sharing can be practically used in many areas such as cloud computing environment, decentralized electronic voting system and blockchain technology.

Key Words: Finite fields, minimal codes, weakly regular plateaued functions, secret sharing schemes.

MSC : 94A60, 14G50, 11T71

REFERENCES

[1] A. Ashikhmin, A. Barg. Minimal vectors in linear codes. IEEE Transactions on Information Theory, 44(5) (1998) 2010-2017.

[2] K. Ding, C. Ding. A class of two-weight and three-weight codes and their applications in secret sharing. IEEE Transactions on Information Theory, 61(11) (2015) 5835-5842.

[3] S. Mesnager, F. Özbudak, and A. Sınak. Linear codes from weakly regular plateaued functions and their secret sharing schemes. Designs, Codes and Cryptography, 87.2-3 (2019) 463-480.

[4] C. Tang, N. Li, Y. Qi, Z. Zhou, T. Helleseth. Linear codes with two or three weights from weakly regular bent functions. IEEE Transactions on Information Theory, 62(3) (2016) 1166-1176.

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Some functions via semi open sets

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ABSTRACT

In 1963, Levine [1] introduced the concepts of semi open sets and semi continuity in topological spaces. Then, in 1965, the α-open sets started with Njåstad [2] and it is shown that $\alpha(X)$ is a topology for a set X. The notions of preopen sets and precontinuous functions in topology defined and studied by Mashhour et al. [3]. After that, Abd El-Monsef et al. [4] introduced the concepts of β-open sets and β-continuity in topological spaces. It is clear that every α-open set imply semi open set or preopen set. Moreover, every semi open set implies β-open set and every preopen set implies β-open set. We recall the concepts of g-closed sets [5], rg-closed sets [6] and δ-open sets [7] in topological spaces. These sets play an important role in the works of generalizations of continuous functions in topology. Recently, by using these sets, many authors defined and investigated various classes (for example: αlc-sets, slc-sets, sglc-sets, srglc-sets, etc.) of these sets and continuity in topological spaces.

In this note is to introduce and study the notions of new types of functions, namely δslc-semi-continuous, δsglc-semi-continuous, δsrglc-semi-continuous. It is the goal of this paper to the relationships between δslc-semi-continuity which is stronger than δsglc-semi-continuity and δsrglc-semi-continuity which is weaker than δsglc-semi-continuity. We also obtained some properties of these functions in topology.

Key Words: semi open set, α-open set, δ-open set.

MSC: 54.

REFERENCES

[1] N. Levine, Semi open sets and semi continuity in topological spaces, Amer. Math. Monthly 70 (1963), 36-41.

[2] O. Njåstad, On some classes of nearly open sets, Pacific J. Math. 15 (1965), 961-970.

[3] A. S. Mashhour, M. E. Abd El-Monsef and S. N. El-Deeb, On precontinuous and weak precontinuous mappings, Proc. Math. Phys. Soc. Egypt 53 (1982), 47-53.

[4] M. E. Abd El-Monsef, S. N. El-Deeb and R. A. Mahmoud, β-open sets and β-continuous mapping, Bull. Fac. Sci. Assiut Univ. A 12 (1983), 77-90.

[5] N. Levine, Generalized closed sets in topology, Rend. Circ. Mat. Palermo (2) 19 (1970), 89-96.

[6] N. Palaniappan and K. C. Rao, Regular generalized closed sets, Kyungpook Math. J. 33 (1993), 211-219.

[7] N. V. Veličko, H-closed topological spaces, Amer. Math. Soc. Transl. 78 (1968), 103-118.

On the alpha distance formulae in three dimensional space

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ABSTRACT

The α-metric for $\alpha \in [0,\pi/4]$ in the real plane, was given first in (Tian, 2005) as a generalization of the well-known taxicab and the Chinese checker metrics. Later, the α-metric for three dimensional space was given in (Gelişgen and Kaya, 2006). Afterwards, the α-metric was extended for $\alpha \in [0,\pi/2)$ in (Çolakoğlu, 2011). According to latest situation, in the plane, for points $P_1=(x_1,y_1)$, $P_2=(x_2,y_2)$, and positive real number $\lambda(\alpha)=(\sec\alpha - \tan\alpha)$ where $\alpha \in [0,\pi/2)$, the α-metric is defined by

$$d_\alpha(P_1,P_2)=\max\{|x_1-x_2|,|y_1-y_2|\}+\lambda(\alpha)\min\{|x_1-x_2|,|y_1-y_2|\}.$$

Geometrically, the α-distance between two points P_1 and P_2 is the sum of lengths of line segments joining the points, one of which is parallel to a coordinate axis and the other one is parallel to a line making angle α with the other coordinate axis, while the Euclidean distance between the points P_1 and P_2 is the length of the straight line segment joining the points.

In this talk, mainly we determine some distance properties of the α-metric in two and three dimensional spaces, whose special cases are given in (Akça and Kaya, 2004) and (Gelişgen at al., 2006). First, we determine the α-distance formulae between a point and a line and two parallel lines in the real plane, using the α-circles, and then using the α-spheres, we determine the α-distance formulae between a point and a plane, two parallel planes, a point and a line, two parallel lines and two skew lines in the three dimensional space, of which we are quite familiar to their Euclidean analogs.

Key Words: Alpha metric, taxicab metric, Chinese checker metric, distance, three dimensional space.

MSC: 51K05, 51K99, 51N20.

REFERENCES

[1] Z. Akça, R. Kaya, On the distance formulae in the three dimensional taxicab space, Hadronic Journal, 27, 521-532, 2004.

[2] H.B. Çolakoglu, Concerning the alpha distance, Algebras Groups Geom., 8, 1-14, 2011.

[3] H.B. Çolakoğlu and R. Kaya, A generalization of well-known distances and related isometries, Math. Commun., 16, 21-35, 2011.

[4] H.B. Çolakoğlu, Ö. Gelişgen and R. Kaya, Area formulas for a triangle in the alpha plane, Math. Commun., 18(1), 123-132, 2013.

[5] H.B. Çolakoğlu, Ö. Gelişgen and R. Kaya, Pythagorean theorems in the alpha plane, Math. Commun., 14 (2), 211-221, 2009.

[6] Ö. Gelişgen, R. Kaya, On α-distance in three dimensional space, Appl. Sci., 8, 65-69, 2006.

[7] Ö. Gelişgen, R. Kaya and M. Özcan, Distance formulae in the Chinese checker space, Int. J. Pure Appl. Mah., 26, 35-44, 2006.

[8] Tian, Alpha distance - A generalization of Chinese checker distance and taxicab distance, Missouri J. Math. Sci., 17, 35-40, 2005.

Astrohelicoidal Surfaces

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ABSTRACT

We assume $\gamma: I \longrightarrow \Pi$ be a curve in a plane Π for an open interval $I \subset \mathbb{R}$, and ℓ be a line in Π. A rotational surface in $\mathbb{E}^3$ is defined as a surface rotating a curve γ profile curve around a line ie. axis ℓ. When a profile curve γ rotates around the axis ℓ, it simultaneously displaces parallel lines which are orthogonal to the axis ℓ, so that the speed of displacement is proportional to the speed of rotation. Hence, obtaining surface is named the helicoidal surface with axis ℓ and pitch $a \in \mathbb{R}^+$. See also (Eisenhart 1909, Forsyth 1920, Gray et al. 2006, Hacısalihoğlu 1982, Nitsche 1989, Spivak 1999) for details.

We construct a new kind helicoidal surface which its profile curve has astroid curve in the three dimensional Euclidean space $\mathbb{E}^3$.

Using rotational matrix in $\mathbb{E}^3$, profile curve γ, and adding translation vector on axis z, we obtain helicoidal surface which has astroid curve. We called resulting surface as astrohelicoidal surface. Taking function $\varphi(u)$ on the profile curve γ, we calculate the Gauss map of the surface. We also find Gaussian curvature and the mean curvature of the astrohelicoidal surface $A(u, v)$. We also draw some figures for the astrohelicoidal surface, and its Gauss map in the three dimensional Euclidean space.

Finally, calculating some differential equations, we give minimality and flatness conditions of the astrohelicoidal surface.

Key Words: astrohelicoidal surface, Gauss map, Gaussian curvature, mean curvature.

MSC: 53, 65.

REFERENCES

[1] L.P. Eisenhart, A Treatise on the Differential Geometry of Curves and Surfaces. Dover Publications, N.Y. 1909.

[2] A.R. Forsyth, Lectures on the Differential Geometry of Curves and Surfaces, Cambridge Un. press, 2nd ed. 1920.

[3] A. Gray, S. Salamon, E. Abbena, Modern Differential Geometry of Curves and Surfaces with Mathematica, Third ed. Chapman & Hall/CRC Press, Boca Raton, 2006.

[4] H.H. Hacısalihoğlu, Diferensiyel Geometri I. Ankara Ün., Ankara, 1982.

[5] J.C.C. Nitsche, Lectures on Minimal Surfaces. Vol. 1. Introduction, Fundamentals, Geometry and Basic Boundary Value Problems. Cambridge Un. Press, Cambridge, 1989.

[6] M. Spivak, A Comprehensive Introduction to Differential Geometry, Vol. IV. Third edition. Publish or Perish, Inc., Houston, Texas, 1999.

Astrohelicoidal hypersurfaces in 4-space

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ABSTRACT

We consider a new kind helicoidal hypersurface which its profile curve has astroid curve in the four dimensional Euclidean space $\mathbb{E}^4$.

$\gamma: I \longrightarrow \Pi$ be a space curve for an open interval $I \subset \mathbb{R}$, and let ℓ be a line in Π. A rotational hypersurface is defined as a hypersurface rotating a curve γ profile curve around axis ℓ in the four dimensional Euclidean space $\mathbb{E}^4$. When a profile curve γ rotates around the axis ℓ, it simultaneously displaces parallel lines which are orthogonal to the axis ℓ, so that the speed of displacement is proportional to the speed of rotation. Hence, obtaining surface is named the helicoidal hypersurface has axis ℓ and pitches a and b for positive real numbers. See some papers (Arslan et al. 2012, Ganchev and Milousheva 2014, Güler et al. 2018, Güler et al. 2019, Güler and Turgay 2019), and books (Eisenhart 1909, Hacısalihoğlu 1994, Nitsche 1989) about hypersurfaces

By using rotational matrix in $\mathbb{E}^4$, and profile curve γ with translation vector on axis x_4, we find helicoidal hypersurface which has astroid curve. Resulting hypersurface we called is astrohelicoidal hypersurface $\mathcal{A}(u,v,w)$. Considering function $\Phi(u)$ on the profile curve γ, we calculate the Gauss map of the hypersurface. Then we find Gaussian curvature and the mean curvature of the astrohelicoidal hypersurface.

We also draw some figures of the astrohelicoidal hypersurface, and its Gauss map with projection from four dimensional Euclidean space to the three dimensional Euclidean space.

Obtaining some second order differential equations, we have minimality and flatness conditions of the astrohelicoidal hypersurface.

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Key Words: 4-space, astrohelicoidal hypersurface, Gauss map, Gaussian curvature, mean curvature.

MSC: 53, 65.

REFERENCES

[1] K. Arslan, B. Kılıç Bayram, B. Bulca, G. Öztürk, Generalized Rotation Surfaces in $\mathbb{E}^4$. Results Math. 61 (2012) 315–327.

[2] L.P. Eisenhart, A Treatise on the Differential Geometry of Curves and Surfaces. Dover Publications, N.Y. 1909.

[3] G. Ganchev, V. Milousheva, General rotational surfaces in the 4-dimensional Minkowski space. Turk. J. Math. 38 (2014) 883–895.

[4] E. Güler, H.H. Hacısalihoğlu, Y.H. Kim, The Gauss map and the third Laplace-Beltrami operator of the rotational hypersurface in 4-Space. Symmetry. 10(9) (2018) 1–11.

[5] E. Güler, M. Magid, Y. Yaylı, Laplace Beltrami operator of a helicoidal hypersurface in four space. J. Geom. Sym. Phys. 41 (2016) 77–95.

[6] E. Güler, N.C. Turgay, Cheng-Yau operator and Gauss map of rotational hypersurfaces in 4-space. Mediterr. J. Math. 16(3) (2019) 1–16.

[7] H.H. Hacısalihoğlu, Diferensiyel Geometri II. Ankara Ün., Ankara, 1994.

[8] J.C.C. Nitsche, Lectures on Minimal Surfaces. Vol. 1. Introduction, Fundamentals, Geometry and Basic Boundary Value Problems. Cambridge Un. Press, Cambridge, 1989.

Countable elementary soft topological spaces

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ABSTRACT

In 1999, Molodtsov [1] introduced the concept of soft sets as a new mathematical tool for dealing with uncertainties. *A soft set* over a universal set is defined as a parametrized family of subsets of the universe set. *A soft element* is a parametrized family of singleton subsets of the universal set. Let *A* be a set of parameters and *X* be a universal set. Let (F,A) and (G,A) be two soft sets over a common universe *X*. $(F,A)$is said to be *null soft set*, denoted by Φ, if for all $\lambda \in A$, $F(\lambda)=\varnothing$. $(F,A)$is said to an *absolute soft set* denoted by $\tilde{X}$, if for all $\lambda \in A$, $F(\lambda)=X$. The collection of the null soft set Φ and the soft sets (F,A) over *X* for which $F(\lambda)\neq\varnothing$, $\forall\lambda\in A$ is denoted by $S(\tilde{X})$ and the collection of all soft elements of $\tilde{E}$ is denoted by $SE(\tilde{X})$.

$(F,A),(G,A)\in S(\tilde{X})$ be soft sets. $(F,A)\tilde{\subseteq}(G,A)$ iff every soft element of (F,A) is also a soft elements of (G,A). Any collection of soft elements of a soft set can generate a soft subset of that soft set. The soft set constructed from a collection B of soft elements is denoted by $SS(\mathrm{B})$. For any soft set $(F,A)\in S(\tilde{X})$, $SS(SE(F,A))=(F,A)$; whereas for a collection B of soft elements, $SE(SS(\mathrm{B}))\supset\mathrm{B}$.

The elementary operations on soft sets are defined as follows. Let $(F,A),(G,A)\in S(\tilde{X})$. *The elementary intersection* (H,A) of the soft sets $(F,A),(G,A)$ is defined as $(H,A)=SS\left(SE(F,A)\cap SE(G,A)\right)$ and it denoted by $(H,A)=(F,A)\circledcirc(G,A)$. *The elementary union* (H,A) of the soft sets $(F,A),(G,A)$ is defined as $(H,A)=SS\left(SE(F,A)\cup SE(G,A)\right)$ and it denoted by $(H,A)=(F,A)\circledR(G,A)$

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Let $\tilde{X}$ be an absolute soft set and $\tau \subset S(\tilde{X})$ be a family of soft sets on X. $\tau \subset S(\tilde{X})$ is called an *elementary soft topology* if it is the following axioms:

1 $\Phi, \tilde{X} \in \tau$,

2 $\{U_i\}_{i\in I} \in \tau \Rightarrow ®_{i\in I} U_i \in \tau$,

3 $\{U_i\}_{i=1}^{n} \in \tau \Rightarrow ©_{i=1}^{n} U_i \in \tau$.

Then the triple $\left(\tilde{X}, \tau, A\right)$ is called an *elementary soft topological space*.

In this work, we define the concept such as first and second countability in elementary soft topological spaces and prove their some basıc properties.

Key Words: Soft set, soft element**,** elementary operations, elementary soft topology, countability.
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MSC: 54, 03.

REFERENCES

[1] Molodtsov, D., Soft sets theory-First results. Comput. Math. Appl., 37(4-5): 19-31, 1999.

[2] Maji, P. K., Biswas, R., Roy, A. R., Soft set theory. Comput. Math. Appl, 45(4-5): 555-562, 2003.

[3] Das, S., Samanta, S. K., Soft real sets, soft real numbers and their properties. J. Fuzzy Math.,20(3): 551-576, 2012.

[4] Das, S., Samanta, S. K., On soft metric spaces. J. Fuzzy Math.,21(3): 707-734, 2013.

[5] Taşköprü, K., Introduction to elemantery soft topological spaces, Ph.D Thesis, Sakarya University, Intitue of Science, 2017.

Ricci solitons on nearly KENMOTSU manifolds with semi-symmetric metric connection

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ABSTRACT

In recent years, Ricci flows (Bejan and Crasmareanu 2014) have been an interesting research topic in Mathematics especially in differential geometry. On a compact Riemannian manifold M with Riemannian metric g, the Ricci flow equation is given by

$$\frac{\partial g}{\partial t} = -2Ricg,$$

such that $Ricg$ is defined as Ricci curvature tensor and t is time. A soliton which is similar to the Ricci flow and which moves only with a one-parameter of the diffeomorphism family and the family of scaling is called a Ricci soliton (Hamilton 1988).

On a Riemannian manifold (M,g), the Ricci soliton is defined by

$$(L_V g)(X,Y) + 2S(X,Y) + 2\lambda g(X,Y) = 0,$$

such that S is the Ricci tensor associated to g (the Ricci tensor S is a constant multiple of g), L_V denoted the Lie derivative operator along the vector field and λ is a real scalar (Nagaraja and Venu 2016).

It is well known that nearly Kenmotsu manifolds can be characterized through their Levi-Civita connection by

$$(\nabla_X \varphi)Y + (\nabla_Y \varphi)X = -\eta(Y)\varphi X - \eta(X)\varphi Y$$

for any vector fields X and Y (Öztürk 2017). Moreover, if M satisfies

$$(\nabla_X \varphi)Y = g(\varphi X, Y)\xi - \eta(Y)\varphi X$$

then it is called Kenmotsu manifold (Kenmotsu 1972). By the way a semi-symmetric manifold is defined by $R(X,Y).R = 0$ for all vector fields X,Y on M, where $R(X,Y)$

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acts as a derivation on R (Nomizu 1968). Such a space is called "semi-symmetric space" since the curvature tensor of (M, g) at a point $p \in M$, R_P is the same as the curvature tensor of a symmetric space (that can change with the point of p) (Öztürk 2017).

In this work, we have studied the geometry of Ricci solitons on nearly Kenmotsu manifolds under semi-symmetric metric conditions. Firstly we give some basic informations about nearly Kenmotsu manifolds, Ricci solitons on a nearly Kenmotsu manifold and structures of semi-symmetric metric connection. Then we investigate Ricci solitons on nearly Kenmotsu manifolds with semi-symmetric metric connection. Also we give some curvature identities about curvature tensor of a Ricci soliton on a nearly Kenmotsu manifold with semi-symmetric metric connection. And then we consider some important results and theorems of Ricci solitons on Ricci-recurrent and φ-recurrent nearly Kenmotsu manifolds with semi-symmetric metric connection. Finale of the present paper is to study Ricci soliton on quasi-projectively flat (or φ-projectively flat) nearly Kenmotsu manifold with respect to semi-symmetric metric connection.

Key Words: Nearly Kenmotsu manifold, Ricci solitons, semi-symmetric metric connection.

MSC: 53C25, 53D10, 53D15, 53C44.

REFERENCES

[1] Nagaraja, H.G., Venu, K., : Ricci Solitons in Kenmotsu Manifold. Journal of Informatics and Mathematical Sciences, 8 (2016), 29

[2] Prasad, R., Kumar, S., Gautam, U.K., : On nearly Kenmotsu manifolds with semi-symmetric metric connection. Ganıta 68(1) (2018), 133

[3] Küpeli Erken, I., Piotr Dacko, Murathan, C.: On the existence of proper nearly Kenmotsu manifolds. Mediterr. J. Math. 13 (2016), 4497--4507.

[4] Öztürk, H.: On α-Kenmotsu manifolds satisfying semi-symmetric conditions. Konuralp Journal of Mathematics, 5 (2017), 192-193.

[5] Kenmotsu, K.: A Class of Contact Riemannian Manifold. Tohoko Math. J., 24(1972), 93-103.

[6] K. Nomizu, On Hypersurfaces Satisfying a Certain Condition on the Curvature Tensor, Tohoko Mat. J., 20(1968), 46-69.

[7] C.L. Bejan, M. Crasmareanu, Second order parallel tensors and Ricci solitons in 3-dimensional normal paracontact geometry, Ann. Glob. Anal. Geom., (2014), doi:10. 1007/s10455-014-9414-4.

[8] R.S. Hamilton: The Ricci flow on surfaces. In: Mathematics and general relativity (Santa Cruz, CA, 1986), Contemp. Math., 71, 237-262. Amr. Math. Soc., Providence (1988).

Focal surface of a tubular surface with darboux frame in IE^3

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ABSTRACT

Focal surfaces are known as line congruences. The concept of line congruences is defined for the first time in visualization in 1991 by Hagen and Pottman.

Canal surface with a significant place in geometry provides benefits in showing human internal organs, long thin objects, surface modelling, CG/ CAD and graphics. Tubular surface is a special case of a canal surface.

In differential geometry, frame fields are important tools for analyzing curves and surfaces. Frenet frame is the most familier frame field but there is also another frame field such as Darboux frame. Besides Frenet frame is constructed on a curve with its velocity and the acceleration vectors, Darboux frame is constructed on a surface with the curves' velocity vector and the surface' normal vector.

Here, we focus on focal surface of a tubular surface in Euclidean 3-space IE^3. Firstly, we give the tubular surface with respect to Darboux frame. Then, we define focal surface of this tubular surface. We get some results for this type of surface to become flat and we show that there is no minimal focal surface of a tubular surface in IE^3. We give an example for this type of surface. Further, we show that u-parameter curves cannot be asymptotic curves and we obtain some results about v-parameter curves of the focal surface M^*.

Key Words: Focal surface, tubular surface, Darboux frame.

MSC: 53A05, 53A10.

REFERENCES

[1] PM. Do Carmo, Differential Geometry of Curves and Surfaces, Englewood Cliffs, Nj, USA, Prentice Hall 1976.

[2] H. Hagen, S. Hahmann, Generalized Focal Surfaces, A New Method for Surface Interrogation, Proceedings Visualization'92, Boston, (1992) 70-76.

[3] H. Hagen, H. Pottmann, A. Divivier, Visualization Functions on a Surface, Journal of Visualization and Animation, 2 (1991) 52-58.

[4] F. Doğan, Y. Yaylı, Tubes with Darboux Frame, Int. J. Contemp. Math. Sciences, 7 (16) (2012) 751-758.

[5] B. Özdemir, A Characterization of Focal Curves and Focal Surfaces in IE^n, Phd Thesis, Uludag University, Bursa, Turkey.

[6] B. Özdemir K. Arslan, On Generalized Focal Surfaces in IE^3, Rev. Bull. Calcutta Math. Soc., 16 (1) (2008) 23-32.

[7] G. Öztürk K. Arslan, On Focal Curves in Euclidean n-Space IR^n, Novi Sad J. Math., 48 (1) (2016) 35-44.

[8] G. Öztürk B. Bulca, B. K. Bayram, K. Arslan, On Canal Surfaces in IE^3, Selçuk Journal of Applied Mathematics, 11 (2) (2010) 103-108.

Separable elementary soft topological spaces

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ABSTRACT

In this work, we define the concept such as density, separability and Lindelöf's properties in elementary soft topological spaces and prove their some basıc properties

A soft set over a universal set is defined as a parametrized family of subsets of the universe set. *A soft element* is a parametrized family of singleton subsets of the universal set. Let A be a set of parameters and X be a universal set. Let F and G be two soft sets over a common universe X. F is said to be *null soft set*, denoted by Φ, if for all $\lambda \in A$, $F(\lambda) = \varnothing$. F is said to an *absolute soft set* denoted by $\tilde{X}$, if for all $\lambda \in A$, $F(\lambda) = X$. The collection of the null soft set Φ and the soft sets (F, A) over X for which $F(\lambda) \neq \varnothing$, $\forall \lambda \in A$ is denoted by $S(\tilde{X})$ and the collection of all soft elements of $\tilde{X}$ is denoted by $SE(\tilde{X})$ [1,2].

Let $\tilde{X}$ be a absolute soft set and $\tau \subset S(\tilde{X})$ be a family of soft sets on X. $\tau \subset S(\tilde{X})$ is called a *elementary soft topology* if it is the following axioms and the triple $(\tilde{X}, \tau, A)$ is called a *elementary soft topological space*.[3]:

1 $\Phi, \tilde{X} \in \tau$,

2 $\{U_i\}_{i\in I} \in \tau \Rightarrow \circledR_{i\in I} U_i \in \tau$,

3 $\{U_i\}_{i=1}^{n} \in \tau \Rightarrow \copyright_{i=1}^{n} U_i \in \tau$.

Let $(\tilde{X}, \mathrm{T}, A)$ be an elementary soft topological space and $F, G \in S(\tilde{X})$ be two non-empty soft sets. F is called *dense soft set in itself* if F is a soft subset of the soft set of limit points F'. F is called *dense soft set in* G if the soft closure $\overline{F}$ of F

is a soft subset of G. F is called *nowhere dense soft set in* $(\tilde{X},\mathrm{T},A)$ if $\overset{o}{\overline{F}}=\Phi$. F is called *everywhere dense soft set in* $(\tilde{X},\mathrm{T},A)$ if $\overline{F}=\tilde{X}$.

Let $(\tilde{X},\mathrm{T},A)$ be an elementary soft topological space and F be a soft set of $S(\tilde{X})$. F is called a *countable soft set* if the family of the soft elements of, $SE(F)$ is countable. $\mathrm{B}\subset SE(\tilde{X})$ be a class of soft elements. $F=SS(\mathrm{B})\in S(\tilde{X})$ is called a *countable soft set* if B is countable. Any an elementary soft topological space $(\tilde{X},\mathrm{T},A)$ is called *separable* iff there is a countable everywhere dense soft set $F\in S(\tilde{X})$.

In this paper, we show that some properties of separable spaces. Also, we research the relationship between separable space and second countable space

An elementary soft topological space $(\tilde{X},\mathrm{T},A)$ is called Lindelöf soft space iff there exists a countable soft subcover of every soft open cover of the soft set $\tilde{X}$.

We satisfy that every soft closed subspace of a Lindelöf elementary soft topological space is also Lindelöf elementary soft topological space with the definition given above. Also, we give some examples and some properties of Lindelöf elementary soft topological soft space.

Key Words: Soft set, soft element**,** elementary operations, elementary soft topology, countability.

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MSC: 54, 03.

REFERENCES

[1] Molodtsov, D., Soft sets theory-First results. Comput. Math. Appl., 37(4-5): 19-31, 1999.

[2] Das, S., Samanta, S. K., Soft real sets, soft real numbers and their properties. J. Fuzzy Math.,20(3): 551-576, 2012.

[3] Taşköprü, K., Elemanter esnek topolojik uzaylara giriş. Doktora tezi, Sakarya Üniversitesi, Fen Bil. Ens., 2017.

[4] Das, S., Samanta, S. K., On soft metric spaces. J. Fuzzy Math.,21(3): 707-734, 2013.

An approximation for null cartan helices in Lorentzian 3-space

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ABSTRACT

In Lorentzian 3-space, there exist three types of curves, namely, spacelike, timelike and null(lightlike) curves according to their causal characters. The timelike curves have many analogies and similarities with the spacelike curves. However, null curves different from the timelike and spacelike curves. Therefore, null curves are often more appropriate to explain physical phenomena.

On the other hand, A helix defined as a curve whose tangent vector makes a constant angle with a fixed direction. The helix has various applications to natural scientists, mathematics, fractal geometry, computer-aided design, computer graphics, physics, etc. Moreover, DNA, carbon nanotube, screws, springs... have the helical shapes and they can be used for the tool path description, the simulation of kinematic motion or the design of highways, etc.

In this work, we introduce a new type of null Cartan helices in Lorentzian 3-space. We investigate the helices with the constant timelike, spacelike and lightlike Killing axis in Lorentzian 3-space. As a result, we calculate the Bishop curvatures of the null Cartan helix. Then, we obtain the explicit parametric equation of these curves by using Bishop curvatures. Finally, we give various related examples and draw their images.

Key Words: Killing vector field, Bishop frame, Cartan frame, Null Cartan curve.
MSC: 53C30, 53C52.

REFERENCES

[1] M. Barros, A. Ferrandez, A conformal variational approach for helices in nature. J. Math. Phys. 50(10), 103529, 2009.

[2] M. Barros, A. Ferrandez, P. Lucas, M.A. Merono, General helices in the three-dimensional Lorentzian space forms. Rocky Mt. J. Math. 31(2), 373– 388, 2001.

[3] M. Barros, General helices and a theorem of Lancret. Proc. Am. Math. Soc. 125(5), 1503–1509, 1997.

Some results on nearly cosymplectic manifolds

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ABSTRACT

Cosympletic manifold is an odd dimensional counterpart of a Kähler manifold which is defined by Lipperman and Blair 1967 [6]. Endo investigated the geometry of nearly cosymplectic manifolds [3].

An almost contact metric structure (φ, ξ, η, g) satisfying $(\nabla_X \varphi)X = 0$ is called a nearly cosymplectic structure [5]

Ricci soliton is a special solution to the Ricci flow introduced by Hamilton [1] in the year 1982. In [2], Ramesh Sharma initiated the study of Ricci solitons in contact Riemanian geometry. Later, Mukut Mani Tripathi [4] ,Nagaraja et al. [5] and others extensively studied Ricci solitons in contact metric manifolds. Ricci soliton in Riemanian manifold (M, g) is a natural generalization of an Einstein metric and is defined as a triple (g, V, λ) with a g Riemanian metric, V a vector field and λ a real scalar such that

$$(L_V g)(X,Y) + 2S(X,Y) + 2\lambda g(X,Y) = 0$$

where S is the Ricci tensor of M and L_V denoted the Lie derivative operator along the vector field V. The Ricci soliton is said to be shrinking, steady and expanding accordingly as λ is negative, zero and positive respectively.

Fisrtly, after we introduce the structure of nearly cosymplectic manifolds, we give basic curvature properties and Ricci solitons on nearly cosymplectic manifolds. After than we give a characterisation of Ricci solitons in generalized φ-recurrent, pseudo-projective φ-recurrent, concircular φ-recurrent and Ricci recurrent nearly cosymplectic manifolds based on the 1-form.

Key Words: Nearly cosymplectic manifold, Ricci solitons, φ-recurrent.

MSC: 53, 57.

REFERENCES

[1] R.S. Hamilton, The Ricci flow on surfaces, `Mathematical and General relativity (Santa Cruz, CA, 1986)', American Math. Soc. Contemp. Math. 71 (1988), 237—262

[2] R. Sharma, Certain results on K-contact and (k,μ)-contact manifolds, J. Geom. 89 (2008),

138–147.

[3] Endo, H.: On the curvature tensor of nearly cosymplectic manifolds of constant ϕ-sectional curvature. An. S¸tiint. Univ. Al. I. Cuza Ia¸si. Mat. 51(2), 439- 454 (2005)

[4] M.M. Tripathi, Ricci solitons in contact metric manifolds, arXiv:0801, 4222v1, [math DG] (2008).

[5] H.G.NagarajaandC.R.Premalatha, Ricci solitons in Kenmotsu manifolds, Journal of Mathematical Analysis 3 (2) (2012), 18–24.

[6] Libermann, P., Sur les automorphismes innit□esimaux des structures symplectiques et de atructures de contact, 1959, Coll. G eom. Di. Globale, pp. 3759.

Generalization of projection of Cartesian functions onto multidimensional surfaces, special focus on two dimensional surfaces

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ABSTRACT

This scientific study is about the mapping of cartesian functions onto surfaces of arbitrary dimensions. Mapping of functions onto a surface helps us to evaluate the value of a function after a transformation applied to the basis vectors. The mapping function can be shown as $Z:(x,y)\rightarrow\vec{F}(x,y,z)$ since $y=f(x)$ the expression (x,y) can be shown as $(x,f(x))$, so we can get $Z:(x,f(x))\rightarrow\vec{F}(x,y,z)$ and since we have the output set of this mapping function as another function it can be found out that the mapping function is $Z=\vec{F}(x,f(x),z)$ where z is the surface equation $z(x,y)$. The z component of the vector can be evaluated as $z(x,f(x))$ using the aforementioned information. In the end we have a function $Z(x,f(x))$ in order not to confuse this x value with the other given information or calculations, it is better to change this parameter to another one which will be called t. In the end we have obtained a mapping function $Z(t,f(t))=\vec{F}\left(t,f(t),z(t,f(t))\right)=\hat{\imath}t+\hat{\jmath}f(t)+\hat{k}z(t,f(t))$. This function can be (and is) generalized for n dimensional surfaces of $\vec{F}(x_1,x_2,x_3,x_n)$.This mapping function is the first part of this study, there is another mapping function which is also about the projection of an arbitrary function onto a surface but in a more rotational way. To be more specific, the firstly mentioned transformation is about the manipulation of the cartesian coordinate system whereas the other one is about the projection of functions onto a manifold of an object. For instance, the mapping function for a cylinder (not to confuse with the first mapping function) is $\mathbb{Z}(t,f(t))=\hat{\imath}\cos(t)+\hat{\jmath}\sin(t)+\hat{k}f(t)$. If we plot the graph of this function for the condition $f(t)=t$, it can be seen that the output is $\mathbb{Z}(t,f(t))=\hat{\imath}\cos(t)+\hat{\jmath}\sin(t)+\hat{k}t$. If we split this function into parts, we will get $x(t)=\cos(t),\ \ y(t)=$

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$\sin(t), z(t) = t$ (Kaya, 2015). We can think of curves in space as paths of a point in motion (Struik, 1950). Such curves we will be discussing through this study were studied by other fellow mathematicians, but they don't generalize the concept of arbitrary functions and surfaces, Conical spiral of pappus (Chasles & Graves, 1845) and spherical helices (Struik, 1950) are such examples.

Key Words: Mapping function, n dimensional surfaces, coordinate systems.

MSC: 53, 33.

REFERENCES

[1] Chasles, Michel & Graves, Charles. *A Treastie on Conic Sections and the Applications of* Algebra *to Geometry* (page 219-231), Cambridge University Press, Cambridge, 1845.

[2] Struik, D. J., Curves. *Lectures on Classical Differential Geometry* (page 23-42), Courier Corporation, Massachusetts, 1950.

[3] Struik, D. J., Curves. *Lectures on Classical Differential Geometry* (page 1), Courier Corporation, Massachusetts, 1950.

[4] Filiz Ertem Kaya. Terquem Theorem with the Spherical Helix Strip. Pure and Applied Mathematics Journal. Special Issue: Applications of Geometry.Vol. 4, No.1-2, 2015 pp.1-5.doi: 10.11648/j.pamj.s.2015040102.11

The category of fuzzy soft topological spaces

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ABSTRACT

Set theory, initiated by George Cantor is one of a milestone of mathematics. In his definition, the sets are crisp and it is clear if an element belongs to a set or not. However, if we aim to model a concept in real life by using the mathematical properties of Cantor's set theory, then we might run into various difficulties due to vagueness that exists in problems related to economics, engineering, medicine, etc. In order to incorporate the vagueness into set theory, many theories have been introduced. The most successful one for these kinds of vague concepts is Zadeh's fuzzy sets [7]. The key idea behind this theory is to have a membership function for the elements of a set. On the other hand, Molodtsov [3] defined soft set theory as a new approach for vagueness, which can be seen as a generalization of fuzzy set theory. Roughly speaking, instead of having only one membership function as originally introduced in fuzzy set theory, one can define the approximate elements of a set by using the parametrized subsets in soft set theory.

As a further improvement, fuzzy soft sets were first introduced by Maji et.al. [2] as a combination of fuzzy and soft sets. This hybrid model gave rise to new scientific studies, papers, and applications. Fuzzy soft topological spaces were first defined by Tanay and Kandemir [6]. Simsekler and Yuksel [4] developed fuzzy soft topology. In these papers fuzzy soft topology is a crisp set containing fuzzy soft sets. Aygunoglu et al. [1] observed the category of fuzzy soft topological spaces (FSTOP) and fuzzificated the fuzzy soft topology by grading the fuzzy soft open and fuzzy soft closed sets from 0 to 1. This idea was initially given by Šostak [5] for fuzzy topologies.

In this paper, we study the category of FST between fuzzy soft topological spaces and define the fuzzy soft initial and fuzzy soft final topologies, respectively. The paper is structured as follows. First, we define fuzzy soft inclusion, fuzzy soft equality, fuzzy soft union, and fuzzy soft intersection. Then we introduce fuzzy soft

topology by using a different approach; namely, we generalize the idea of Šostak [5]. Accordingly, we define fuzzy soft continuous mappings and also the category of FST. Finally, we give the initial and final fuzzy soft topological spaces.

Key Words: fuzzy soft topology, category

MSC: 54A40, 06D72

REFERENCES

[1] Aygunoglu A, Cetkin V, Aygun H. An introduction to fuzzy soft topological spaces. Hacettepe Journal of Mathematics and Statistics 2014; 43: 197-208.

[2] Maji PK, Roy AR, Biswas R. Fuzzy soft sets. Journal of Fuzzy Mathematics 2001; 9 (3): 589-602.

[3] Molodtsov D. Soft set theory-First results. Computers and Mathematics with Applications 1999; 37 (4-5): 19-31.

[4] Simsekler T, Yuksel S. Fuzzy soft topological spaces. Annals of Fuzzy Mathematics and Informatics 2013; 5 (1): 87-96.

[5] Šostak, A. On a fuzzy topological structure. In: Proceedings of the 13th Winter School on Abstract Analysis, Palermo, 1985, pp. 89-103.

[6] Tanay B, Kandemir MB. Topological structure of fuzzy soft sets. Computers and Mathematics with Applications 2011; 61: 2952-2957.

[7] Zadeh LA. Fuzzy sets. Information and Control 1965; 8: 338-353.

The fixed point theorem and characterization of bipolar metric completeness

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ABSTRACT

The fixed point theory is used in many different fields of mathematics such as topology, analysis, nonlinear analysis and operator theory. Moreover, it can be applied to different disciplines such as statistics, economy, engineering, etc. The studies of fixed point theory covers a wide range. The most basic and famous fixed point theorem is Banach fixed point theorem. It guarantees the existence and uniqueness of solution of a functional equation. Besides Banach, many different fixed point theorems were introduced such as Kannan, Caristi, Coupled, Suzuki, etc.

In literature, there are many kind of metric spaces as partial, rectangular, cone, b-metric, etc. A new one to them is bipolar metric spaces. The concept of bipolar metric space was introduced by Mutlu and Gürdal in 2016, considering them only isometrically without exploring their topological structures in detail. They gave some basic definitions and examples about bipolar metric spaces and described maps and sequences, study completeness, discuss some related properties and gave some fixed point theorems such as Banach, Kannan. After that, Mutlu, Özkan and Gürdal proved coupled fixed point theorems for covariant and contravariant contractive mappings on these metric spaces. In addition this, they gave some fixed point theorems for multivalued covariant and contravariant mappings and examined some properties of them.

The main result of this study is a fixed point theorem which extends many fixed point theorems for contravariant contraction mappings on bipolar metric spaces. In addition, using this fixed point theorem, it has been given a characterization of bipolar metric completeness.

Key Words: Fixed point theory, bipolar metric spaces, completeness.
MSC: 46, 54.

REFERENCES

[1] Y. Enjouji, M. Nakanishi, and T. Suzuki, A generalization of Kannan's fixed point theorem, Fixed Point Theory and Applications 2009 (2009) Article ID 192872, 10 pages.

[2] R. Kannan, Some results on fixed points, Bulletin of the Calcutta Mathematical Society 60 (1968) 71–76.

[3] M. Kikkawa and T. Suzuki, Three fixed point theorems for generalized contractions with constants in complete metric spaces, Nonlinear Analysis: Theory, Methods & Applications 69 (9) (2008) 2942–2949.

[4] A. Mutlu, U. Gürdal, Bipolar metric spaces and some fixed point theorems, J. Nonlinear Sci. Appl. 9(9) (2016) 5362–5373.

[5] A. Mutlu, K. Özkan, U. Gürdal, Coupled fixed point theorems on bipolar metric spaces, European Journal of Pure and Applied Mathematics 10 (4) (2017) 655–667.

[6] A. Mutlu, K. Özkan, U. Gürdal, Fixed point theorems for multivalued mappings on bipolar metric spaces, Fixed Point Theory, in press.

[7] T. Suzuki, A generalized Banach contraction principle that characterizes metric completeness, Proceedings of the American Mathematical Society 136 (5) (2008) 1861–1869.

[8] T. Suzuki and M. Kikkawa, Some remarks on a recent generalization of the Banach contraction principle, Journal of Inequalities and Applications 2016 (1) (2016) 151-161.

A caristi type fixed point theorem on M_b -metric space

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ABSTRACT

Because of Banach contraction principle's important, this principle has generalized and extended in different ways. In this sense, one of the most interesting result is obtained by Caristi [1] known as Caristi fixed point theorem. Besides, Ekeland obtained a result for a variational principle which has many applications to great number of branches in mathematics such as nonlinear analysis, differential geometry. Then, it was shown that Caristi fixed point theorem is equivalent to Ekeland variational principle. So, by virtue of its applicability, Caristi fixed point theorem has been extended and generalized by many authors. On the other hand, Czerwik [2] defined the notion of b-metric space to generalize concept of standart metric. However, any b-metric d has a disadvantage. Although standard metric is continuous, b-metric may not be continuous. To remedy this lack, Kirk et al.[3] defined the strong b-metric space. Very recently, Nabil et al. [4] defined the concept of M_b-metric. Then, Sahin et al. [5] modified their definition as more suitable to generalize the ordinary metric and the b-metric. In this paper, first, we introduce the concept of strong M_b-metric which is an extension of strong b-metric. Then, we investigate that whether Caristi fixed point theorem is extend to strong M_b-metric space and we show that this result cannot be obtained on strong M_b-metric spaces. To overcome this problem, we suggest a new mapping so called Caristi mapping of new type and so that, we obtain Caristi type fixed point theorem on strong M_b-metric space.

Key Words: Strong M_b-metric, fixed point, Caristi fixed point theorem

MSC: 54H25, 47H10.

REFERENCES

[1] J. Caristi,Fixed Point Theorems for Mapping Satisfying Inwardness Condition, Trans. Amer. Math. Soc., 215, 1976.

[2] S. Czerwik, Contraction Mappings in$b$-metric Spaces, Acta Math. Univ. Ostrav., 1, 1993.

[3] W. Kirk, N. Shahzad, Fixed Point Theory in Distance Spaces, Springer, 2014.

[4] N. Mlaiki, A. Zarrad, N. Souyah, A. Mukheimer,T. Abdeljawed, Fixed Point Theorems in M_b-metric spaces, Journal of Mathematical Analysis, 7, 2016.

[5] H. Sahin, I. Altun, D. Turkoğlu, Fixed Point Results for Multivalued Mappings of Feng-Liu Type on M_b-metric spaces, Mathematical Methods In Engineering, Springer, 2019.

Soft partial metric spaces

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ABSTRACT

Molodtsov [1] introduced the concept of soft sets in 1999 and then there have been many works about associating and applying soft sets to various mathematical structures especially algebraic and topological structures. After Shabir and Naz [2] introduced the notion of soft topological space, many authors studied on soft topological spaces considering the concept of soft point. Then, Das and Samanta introduced notions of soft element, soft reel set and number and soft complex set and number over soft sets [3, 4]. Samanta et al. and several authors examined some mathematical structures such as soft topology [5], soft metric, soft vector, soft norm, etc. by using the notion of soft element.

On the other hand, in 1994, Matthews introduced [6, 7] partial metric spaces to provide mechanism generalizing metric space theories. This is a relatively new field and has vast application potentials in the study of computer domains and semantics [8]. There have been different approaches in this area when it comes to applying the developing mathematical concepts to computer science.

In this study, we introduce soft partial metric spaces. We first define the concept of soft partial metric according to soft element and then describe some of its properties and give some examples. We show that every parametrized family of crisp partial metrics $\{p_\lambda : \lambda \in A\}$ on a crisp set X is a soft partial metric on the absolute soft set $\tilde{X}$ and every crisp partial metric ρ on a crisp set X can be extended to a soft partial metric on the absolute soft set $\tilde{X}$. The soft partial metric is more general and comprehensive than any parametrized family of the crisp partial metrics. Then, we give following theorem for about which soft partial metric is a parameterized family of crisp partial metrics.

Theorem: If a soft partial metric space p on $\tilde{X}$ satisfies the following axiom (P5) and if for $\lambda \in A$, $p_\lambda : X \times X \to \mathbb{R}^* = [0,\infty)$ is defined by $p_\lambda\left(\tilde{x}(\lambda), \tilde{y}(\lambda)\right) = p(\tilde{x}, \tilde{y})(\lambda)$, $\tilde{x}, \tilde{y} \in \tilde{X}$ then p_λ is a partial metric on X.

(P5) For $(r,s) \in X \times X$ and $\lambda \in A$, $\left\{p(\tilde{x}, \tilde{y})(\lambda) : \tilde{x}(\lambda) = r, \tilde{y}(\lambda) = s\right\}$ is a singleton set.

Finally, we investigate topology of soft partial metric spaces. We first define soft open ball, soft neighbourhood and soft open set in soft partial metric spaces. We prove some of their properties and we show that the family of all soft open sets in a soft partial metric space is an elementary soft topological space under some conditions.

Theorem: Every soft partial metric space satisfying the axiom (P5) is a elementary soft topological space.

Key Words: Soft set, soft metric, soft topology, soft partial metric.

MSC: 54E35, 03E99.

REFERENCES

[1] D. Molodtsov, Soft set theory-first results, Comput. Math. Appl. 37 (1999) 19-31.

[2] M. Shabir, M. Naz, On soft topological spaces, Comput. Math. Appl. 61 (2011) 1786-1799.

[3] S. Das, S. K. Samanta, Soft real sets, soft real numbers and their properties, J. Fuzzy Math. 20 (2012) 551-576.

[4] S. Das, S. K. Samanta, On soft metric spaces, J. Fuzzy Math. 21 (2013) 707-734.

[5] K. Taşköprü, A. Altıntaş, On elementary soft topology, in review.

[6] S. Matthews, Partial Metric Topology, in: Proceedings of the 8th Summer Conference on Topology and its Applications, vol. 728, Annals of The New york Academy of Sciences, 1994, pp. 183–197.

[7] S. Matthews, Partial Metric Spaces, http://www.dcs.warwick.ac.uk/pmetric, Official web-page of Partial Metric Spaces.

[8] R. Kopperman, S. Matthews, H. Pajoohesh, What do partial metrics represent?, Spatial representation: discrete vs. continuous computational models, Dagstuhl Seminar Proceedings, no. 04351, Internationales Begegnungs- und Forschungszentrum fuer Informatik (IBFI), Schloss Dagstuhl, Germany, 2005.

An application in the diagnosis of prostate cancer with the help of bipolar soft rough sets

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ABSTRACT

In this study, we introduce for the first time concepts of soft S-lower positive, soft S-lower negative, soft S-upper positive and soft S-upper negative approximations considering both a subset of initial universe and complement of this subset. Then, we define concept of bipolar soft rough sets based on these approximations. We are inspired of the method given by F. Karaaslan and N. Çağman in [2]. And applied this method by using our approximations to a medicine problem calculating the risk of prostate cancer. Our datas are prostate specific antigen (PSA), free prostate specific antigen (fPSA), prostate volume (PV) and age factors of 78 patients from Necmettin Erbakan University Medicine Faculty. A doctor cannot understand whether a patient has prostate cancer only by looking at the factors of PSA, fPSA, PV and Age. Biopsy is required for a definitive diagnosis and the doctor should refer to this procedure. However, in the case of biopsy for diagnosis, the cancer can spread to other vital organs. For this reason decreasing the number of the biyobsy process is an important problem. In this regard, we aim to help doctors. Also, we compared the new approach that we defined in our study and the approach given by F. Karaaslan and N. Çağman [2].

Key Words: Bipolar soft set, Bipolar soft covering based rough set, Decision making.

MSC : 03E20, 03E75, 28E15, 97E60.

REFERENCES

[1] L. Benecchi , Neuro-fuzzy system for prostate cancer diagnosis, Urology 68 (2) (2006) 357-361.

[2] F. Karaaslan and N. Çağman N., Bipolar soft rough sets and their applications in decision making, Afr. Mat. 29 (2018) 823-839.

[3] I. Saritas, N. Allahverdi and U. Sert, A fuzzy expert system design for diagnosis of prostate cancer, International Conference on Computer Systems and Technologies-CompSysTech, 2003.

[4] I. Saritas, I.A. Ozkan and U. Sert, Prognasis of prostate cancer by artificial neural networks, Expert Systems with Applications 37 (2010) 6646-6650.

[5] H. Seker, M.O. Odetayo, D. Petrovic and R.N.G. Naguib, A fuzzy logic based-method for prognostic decision making in breast and prostate cancers, IEEE Transactions on Information Technology in Biomedicine, 7 (2) (2003) 114-122.

[6] Ş. Yuksel, T. Dizman, G. Yildizdan and U. Sert, Application of soft sets to diagnose the prostate cancer risk, Journal of Inequalities and Applications 229, 2003.

[7] Ş. Yuksel, G.Z. Ergül and N. Tozlu, Soft Covering Based Rough Sets and Their Application, The Scientific Word Journal, Article ID 970893, 2014.

[8] Ş. Yuksel, N. Tozlu, T. Dizman, An Application of Multicriteria Group Decision Making by Soft Covering Based Rough Sets, 29 (1) (2015) 209-219.

Symplectic submersions

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ABSTRACT

Let M be an even dimensional differentiable manifold and Ω a global 2-form on M. If Ω is closed and non-degenerate, then (M, Ω) is called symplectic manifold. Infact, since nondegeneracy says that the top exterior power of a symplectic form is a volume form, symplectic manifolds are necessarily even-dimensional and orientable.

Although, symplectic geometry first provided a language for classical mechanics, nowadays, such manifolds have many applications in different research areas and symplectic geometry has own research agenda. In mathematical context, symplectic manifolds have been used and applied to Arnold conjecture, pseudo-holomorphic curves, topology, Seiberg-Witten invariants. Symplectic manifolds have also relations with analysis, low-dimensional topology and mathematical physics [1].

Riemannian submersions between Riemannian manifolds were studied by O'Neill [6] and Gray [4] . Later such submersions were considered between manifolds with differentiable structures. In [8], Watson defined almost Hermitian submersions between almost Hermitian manifolds and he showed that the base manifold and each fibre have the same kind of structure as the total space, in most cases. We note that almost Hermitian submersions have been extended to the almost contact manifolds [2], locally conformal K\"{a}hler manifolds [7] and quaternion K\"{a}hler manifolds [5].

In this talk, we introduce symplectic submersions between symplectic manifolds, provide examples and check the character of the base manifold when we have symplectic submersions. We also check the existence of connection on the symplectic manifold.

Key Words: Riemannian submersion, Symplectic manifold, Symplectic submersion

MSC : 53D, 37J10

REFERENCES

[1] Cannas da Silva, A., Lectures on Symplectic Geometry

[2] Chinea, D. Almost contact metric submersions. Rend. Circ. Mat. Palermo, (1985), 34(1), 89-104.

[3] Falcitelli, M., Ianus, S., Pastore, A. M., {\it Riemannian Submersions and Related Topics}. World Scientific, River Edge, NJ, 2004.

[4] Gray, A. Pseudo-Riemannian almost product manifolds and submersions, J. Math. Mech., (1967), 16, 715-737.

[5] Ianus, S., Mazzocco, R., Vilcu, G. E., Riemannian submersions from quaternionic manifolds. Acta Appl. Math., (2008), 104(1), 83-89.

[6] O'Neill, B. The fundamental equations of a submersion, Mich. Math. J., (1966), 13, 458-469.

[7] J. C., Rocha, J. Locally conformal K\"{a}hler submersions. Geom. Dedicata, (1994), 52(3), 271-289.

[8] Watson, B. Almost Hermitian submersions. J. Differential Geometry, (1976), 11(1), 147-165.

Integrability of generalized f-structures

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ABSTRACT

A structure on n- dimensional manifold M given by a nonnull tensor field F satisfying

$$F^3 + F = 0$$

is called an F-structure. In this case, M is called an F-manifold. The rank of F is constant. Denoting the rank of F by r, if $n = r$, then F-structure isan almost complex structure. If n -1 = r and orientable then F- structure becomes an almost contact structure. F-structure was defined by Yano in [8]. Later, by using this idea many new geometric concepts have been introduced. For examples, globally framed F- manifold was defined and studied by Goldberg-Yano [2], very recently almost Kenmotsu F-manifolds have been defined and studied in [1].

On the other hand, as a unification and extension of usual notions of complex manifolds and symplectic manifolds, the notion of generalized complex manifolds was introduced by Hitchin [4]. This subject has been studied widely in [3] by Gualtieri. A central idea in generalized geometry is that $TM \oplus TM^*$ should be thought of as a generalized tangent bundle to manifold M. If X and ξ denote a vector field and a dual vector field on M respectively, then we write (X, α) (or $X + \alpha$) as a typical element of $TM \oplus TM^*$. The space of sections of the vector bundle $TM \oplus TM^*$ is endowed with IR- bilinear operation: for the sections (X, α), (Y, β) of $TM \oplus TM^* = \mathcal{TM}$,
the Courant bracket $[\![,]\!]$ is defined by

$$[\![(X, \alpha), (Y, \beta)]\!] = [X, Y] + L_X\beta - L_Y\alpha - \tfrac{1}{2}d(i_X\beta - i_Y\alpha).$$

Motivated by Hitchin's and Gualtieri's papers, generalized subtangent manifolds, generalized contact manifolds and generalized paracomplex manifolds have been defined and studied in [5], [7]. Recently, Vaisman defined the notion of generalized F-structure and generalized CRF-structures [6]. He investigated main properties of CRF- manifolds and generalized metric CRF-manifolds. Among other things, he showed that generalized metric CRF-manifolds are a generalization of generalized Kaehler manifolds. And then he introduced generalized CRFK-manifolds.

In this talk, we continue investigate generalized CRF- manifolds. We mainly obtain necessary and sufficient conditions for generalized *F*-structures to be integrable.

Key Words: *F*- structure, Generalized *F* -structure, CRF-structure.

MSC : 22A22, 53C15.

REFERENCES

[1] Falcitelli, M. Pastore, A. M. Almost Kenmotsu *f*- manifolds, Balkan J.Geom. Appl. 12 (2007), no. 1, 32-43

[2] Goldberg, Samuel I.; Yano,Kentaro On normal globally framed f-manifolds, Tohoku Math. J. (2) 22 (1970), 362-370.

[3] Gualtieri, M., Generalized complex geometry, Ph.D. Thesis, Univ. Oxford, arXiv:ma.th.DG/0401221, (2003).

[4] Hitchin, N., Generalized Calabi-Yau manifolds, Q. J. Math., 54, (2003), 281-308.

[5] Poon, Y. S., Wade, A., Generalized contact structures, J. Lond. Math. Soc83(2), (2011), 333-352.

[6] Vaisman, I., Generalized CRF-structures. Geom. Dedicata 133 (2008), 129-154.

[7] Wade, A., Dirac structures and paracomplex manifolds, C. R. Acad. Sci. Paris, Ser. I, 338, (2004), 889-894.

[8] Yano, K., On a structure defined by a tensor field f of type (1, 1) satisfying $F^3 + F = 0$, Tensor (N.S.) 14, (1963), 99-109.

Stability of harmonic maps between Kaehler manifolds and Nearly Kaehler manifolds

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ABSTRACT

Harmonic morphism has been an important research area of differential geometry. In theoretical physics, harmonic maps are also known as sigma models. When Eells and Sampson have introduced this subject one of their first result showed that a holomorphic map between Kaehler manifolds is a harmonic map [3]. This result has been extended to Sasakian manifolds by Ianus [5], Kenmotsu manifolds by Yaning Wang to quaternionic Kaehler manifolds by Ianus, Mazzocco and Vilcu.

A map F: M → N , between Riemannian manifolds is harmonic if it is a critical point of the energy functional of F. Since the tension field of a map is the trace of second fundamental form, every totally geodesic maps is also harmonic map. Therefore, harmonic maps include maps that send each geodesic to the geodesic and maps that maintain parallel displacement.

Moreover, let M and N be a Riemannian manifolds. A map F : M → N is called a harmonic morphism if for any harmonic function f: V → $\mathbb{R}$, defined on an open subset V⊂ N with φ^{-1}(V) non-empty, f ∘ φ : φ^{-1}(V) → $\mathbb{R}$ is a harmonic function.

In this talk, we first check the harmonicity of nearly Kaehler manifolds and the by using the harmonicity, we investigate the stability of such harmonic maps. We also investigate stability of harmonic maps between nearly Kaehler manifolds and Kaehler manifolds.

Key Words: harmonic maps, Kaehler manifolds, nearly Kaehler manifolds

MSC: 53C43, 53C15.

REFERENCES

[1] P. Baird, J. Wood, Harmonic morphisms between Riemannian manifolds, Oxford: Oxford University Press, 2003.

[2] D. Burns, F. Burstall, P. De Bartolomeis and J. Rawnsley, Stability of harmonic maps of Kaehler manifolds, J. Differential Geometry, 30: 579-594, 1989.

[3] J. Eells, J. H. Sampson, Harmonic mappings of Riemannian manifolds, Amer. J. Math. , 86: 109-160, 1964.

[4] C. Gherghe, S. Ianus and A. M. Pastore, CR-manifolds, harmonic maps and stability, J. Geom. , 71: 42-53, 2001.

[5] S. Ianus, R. Mazzocco, G. E. Vilcu, Harmonic maps on contact metric manifolds, Ann. Math. Blaise Pascal 2, 43-55, 1995.

[6] P. F. Leung, On the stability of harmonic maps, In Harmonic Maps, Tulane 1980, Lect. Notes Math. 949, 122-129, 1982.

[7] H. Urakawa, Calculus of variations and harmonic maps. Providence, RI: American Mathematical Society, 1993

[8] H. Urakawa, Stability of harmonic maps and eigenvalues of the laplacian , Transactions of The American Mathematical Society, 301(2): 1987.

Curvatures of hemi-slant submanifolds

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ABSTRACT

CR-submanifolds of Kaehler manifolds were introduced by Bejancu as a generalization of totally real submanifolds and holomorphic submanifolds. (Bejancu 1986). Slant submanifolds of Kaehler manifolds were defined by Chen as another generalization of totally real submanifolds and holomorphic submanifolds. A slant submanifold is called proper if it is neither totally real nor holomorphic.

On the other hand, hemi-slant submanifolds of Kaehler manifolds were defined by Carriazo under the name of anti-slant submanifolds. However, the term 'anti-slant' may suggest that the submanifolds have no slant part. (Carriazo 2000).

Therefore the second author used the notion of Hemi-slant submanifolds and he studied various properties of such submanifolds. He also considered warped product Hemi-slant submanifolds. We note that Chen-Blair studied curvatures of CR-submanifolds of Kaehler manifolds and they obtain a characterization in terms of Riemann Christoffel curvature tensor field. (Sahin 2009).

Moreover, Chen showed that a CR-submanifold becomes holomorphic submanifold or anti-invariant submanifold under certain conditions imposed on the curvature of ambient manifold, see [1] for the above results and related theorems and corollaries.

In this talk, we consider curvatures of hemi-slant submanifolds of Kaehler manifolds. We first obtain a characterization of hemi-slant submanifolds in a complex space form, then we investigate the existence (or non-existence) of hemi-slant submanifolds by imposing certain conditions on the curvatures such holomorphic sectional curvature and Ricci tensor.

We observe that our results are strikingly different from the above results of CR-submanifolds.

Key Words: Kaehler manifolds, hemi-slant submanifolds, curvatures.

MSC : 53C42 , 53C15

REFERENCES

[1] A. Bejancu, Geometry of CR-Submanifolds, Kluwer, Dordrecht, 1986.

[2] R. L. Bishop and B. O'Neill, Manifolds of negative curvature, Trans. Amer. Math. Soc. 145 (1969), 1–49.

[3] V. Bonanzinga and K. Matsumoto, Warped product CR-submanifolds in locally conformal Kaehler manifold, Period. Math. Hungar. 48 (2004), 207–221

[4] J. L. Cabrerizo, A. Carriazo, L. M. Ferna´ndez and M. Ferna´ndez, Semi-slant submanifolds of a Sasakian manifold, Geom. Dedicata 78 (1999), 183–199.

[5] A. Carriazo, Bi-slant immersions, in: Proc. ICRAMS 2000, Kharagpur, India, 2000, 88–97.

[6] B. Sahin, Warped product submanifolds of Kaehler manifolds with a slant factor, Annales Polonici Mathematici 95.3 (2009), 207-226.

Lokal T_0 constant filter convergence spaces

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ABSTRACT

A filter space is a generalisation of a topological space based on the concept of convergence of filters (or nets) as fundamental. Therefore, filters use to describe convergence in general topological space and to characterize such important concepts as continuity, initial and final structures, compactness. Also, filters play a important role in the development of fuzzy spaces which have applications in computer science and engineering. Filters were introduced by H. Cartan in 1937 and subsequently used by Bourbaki in their book *Topologie Générale* as an alternative to the similar notion of a net developed in 1922 by E. H. Moore and H. L. Smith. All the fundamentals of general topology are developed using filter convergence by Kowalsky in 1954. In 1979, Schwarz introduced the category **ConFCO** of constant filter convergence spaces and continuous maps and Schwarz defined as below:

Let X be a set. A mapping K from X into the power set of the set of all filters on X is called a convergence structure on X and (X, K) a constant filter convergence space if the following hold for all $x \in X$:

(i) $[x]$ belongs to K.

(ii) If $\alpha \subset \beta$ and $\alpha \in K$ implies $\beta \in K$ for any filter β on X.

A map $f : (X,K) \longrightarrow (Y,L)$ between constant filter convergence spaces is called continuous if and only if $\alpha \in K$ implies $f(\alpha) \in L$ (where $f(\alpha)$ denotes the filter generated by $\{ f(D) \mid D \in \alpha \}$ i.e., $f(\alpha)=\{ U \subset X : \exists D \in \alpha$ such that $f(D) \subset U \}$). The category of constant filter convergence spaces and continuous maps is denoted by **ConFCO**.

Various generalizations of the usual separation properties at a point p are given by M. Baran in 1991 and 1995. There are several ways to generalize the usual T_0 axiom of topology to topological categories. T_0 objects use to define various forms of (pre)Hausdorff objects in arbitrary topological categories and the notion of closed

subobject of an object of a topological category which is used in the compactness, regular, completly regular, and normal objects

The main goal of this paper is to give the definition of local T_0 constant filter convergence spaces and examine some invariance properties of them.

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Key Words: Topological category, local T_0 spaces, constant filter convergence spaces.

MSC: 54B30, 54D10, 54A05, 54A20, 18B99, 18D15.

REFERENCES

[1] F. Schwarz, T.U. Hannover, Connections Between Convergence and Nearness, The series Lecture Notes in Mathematics, 719, 345-357, 1979.

[2] J. Adamek,, H. Herrlich, G.E. Strecker, Abstract and Concrete Categories, New York,USA, Wiley, 1990.

[3] L.D. Nel,., Initially structured categories and cartesian closedness, Canadian J.Math., 27, 1361-1377, 1975.

[4] M. Baran, Separation Properties, Indian J. Pure Appl. Math., 23, 333-341, 1991.

[5] M. Baran, Separation Properties In Categories Of Constant Convergence Spaces, Turkish Journal Of Mathematics, 18, 238-248, 1994.

[6] M. Baran, Generalized Local Separation Properties, Indian J. Pure Appl. Math., 25, 615-620, 1994.

[7] M. Baran, H. Altındis¸, T_0-objects in topological categories, J. Univ. Kuwait (Sci.) 22, 123-127, 1995.

[8] M. Baran, Separation Properties in Topological Categories, Math Balkanica 10, 39-48, 1996.

Closure operators in constant filter convergence spaces

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ABSTRACT

The study of filters is a very natural way to talk about convergence in an arbitrary topological space. Topological notions such as convergence, limit, separation, and continuity are defined based on axioms for convergence instead of neighborhood. Particularly, filter convergence and net convergence are very useful notions to deal with compactness in terms of cluster points and limit points. One is the concept of a filter, introduced by Cartan in 1937 and the other is the concept of a net, introduced by Moore and Smith in 1922. Furthermore, Choquet, Hausdorff, Katetov, Kent, and others used the concept of convergence in their works. In fuzzy topology also the notion of convergence plays an important role to deal with limit and continuity.

Filter convergence spaces are used by Kowalsky in 1954 and In 1979, Schwarz introduced the category **ConFCO** of constant filter convergence spaces and continuous maps: Let *X* be a set and *F(X)* set of all filters on *X* and *K* be a function from *X to P(F(X)).* If *K* is satisfies the following conditions, (*X*, *K*) is called a constant filter convergence space.

(1) [*x*] belongs to *K*.

(2) If $\alpha \subset \beta$ and $\alpha \in K$ implies $\beta \in K$ for any filter β on *X.*

Closure operators appear in many fields in algebra, topology, geometry, logic, combinatorics, computer science, relational data bases. Dikranjan and Giuli introduced the concept of closure operator of an arbitrary topological category in 1987. They used this to characterize the epimorphisms of the full subcategories of the given topological category.

Let ε be a set based topological category. A closure operator *C* of ε is an assignment to each subset *M* of (the underlying set of) any object *X* of a subset *CM* of *X* such that:

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(1) $M \subset CM$,

(2) $CN \subset CM$ whenever $N \subset M$

(3) For each $f{:}X \longrightarrow Y$ in ε and $M \subset Y$, $C(f^{-1}(M) \subset f^{-1}(CM))$, or equivalently, $f(CM) \subset C(f(M))$.

In 1991, Baran introduced the notion of (strong) closedness in set-based topological categories and used these notions to generalize each of the notions of compactness, connectedness, Hausdorffness, perfectness, regular, completely regular, and normal objects to arbitrary set-based topological categories.

The aim of this paper is to give the characterization of (strongly)closed subobjects of an object in category of constant filter convergence spaces and to show that they form appropriate closure operators in the sense of Dikranjan and Giuli.

Key Words: Topological category, closure operator, T_1 object, constant filter convergence spaces.

MSC: 54B30, 54D10, 54A05, 54A20, 18B99, 18D15.

REFERENCES

[1] J. Adamek, H. Herrlich, G.E. Strecker, Abstract and Concrete Categories, New York,USA, Wiley, 1990.

[2] D. Dikranjan and E. Giuli, Closure operators I, Topology Appl., 27, 129-143, 1987.

[3] D. Dikranjan and W. Tholen, Categorical Structure of Closure Operators, Kluwer Academic Publishers, Dordrecht 1995.

[4] M. Baran, Separation Properties, Indian J. Pure Appl. Math., 23, 333–341, 1991.

[5] M. Baran, The Notion of Closedness in Topological Categories, Comment. Math. Univ. Carolinae, 34,383–395, 1993.

[6] M. Baran, Separation Properties In Categories of Constant Convergence Spaces, Turkish Journal Of Mathematics, 18, 238-248, 1994.

[7] M. Baran, Closure Operators in Convergence Spaces, Acta Math. Hungar., 87, 33–45, 2000.

[8] M. Baran, S. Kula, T. M. Baran, and M. Qasim, Closure Operators in Semi-Uniform Convergence Spaces, *Filomat*, 30, 131-140, 2016.

Some results on generalized φ-recurent almost cosymplectic (κ,μ) spaces

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ABSTRACT

The notion of an almost cosymplectic manifold was introduced by Goldberg and Yano in 1969 [1]. The simplest examples of such manifolds are those being the products (possibly local) of almost Kaehlerian manifolds and the real line R or the circle S. Curvature properties of almost cosymplectic manifolds were studied mainly by Goldberg and Yano [1], Olszak [2] and Endo [3].

Blair at al. [4] introduced the notion of (κ,μ) contact metric manifolds, where κ and μ are real numbers. The full classification of these manifolds was given by Boeckx [5]. Later Koufogiorgos and Tsichlias [6] introduced the generalized (κ,μ) contact metric manifolds where and are real functions and they gave several examples.

Ricci soliton is a special solution to the Ricci flow introduced by Hamilton [7] in the year 1982. In [8], Ramesh Sharma initiated the study of Ricci solitons in contact Riemanian geometry. Ricci soliton in Riemanian manifold (M,g) is a natural generalization of an Einstein metric and is defined as a triple (g,V,λ) with a g Riemanian metric, V a vector field and λ a real scalar such that

$$(L_V g)(X,Y)+2S(X,Y)+2\lambda g(X,Y)=0$$

where S is the Ricci tensor of M and L_V denoted the Lie derivative operator along the vector field V. The Ricci soliton is said to be shrinking, steady and expanding accordingly as λ is negative, zero and positive respectively.

Fisrtly, we introduce the structure of on generalized φ-recurent almost cosymplectic (κ,μ) spaces, we give basic curvature properties and Ricci solitons on generalized φ-recurent almost cosymplectic (κ,μ) spaces. After than we give a

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characterisation of Ricci solitons in generalized pseudo-projective generalized φ-recurent almost cosymplectic (κ,μ) spaces, concircular φ-recurent almost cosymplectic (κ,μ) spaces and Ricci recurrent generalized φ-recurent almost cosymplectic (κ,μ) spaces based on the 1-form.

Key Words: Almost cosymplectic (κ,μ) spaces , ϕ-recurent, Ricci solitons.

MSC: 53, 57.

REFERENCES

[1] Goldberg S.I. and Yano K. Integrability of almost cosymplectic structures, Pasific J. Math., 31 (1969), 373-382..

[2] Olszak Z., Almost cosymplectic manifolds with Kahlerian leaves, Tensor N. S., 46 (1987), 117-124.

[3] Endo H., On Ricci curvatures of almost cosymplectic manifolds, An. S tiint. Univ. "Al. I. Cuza" Ia si, Mat., 40 (1994), 75-83.

[4] Blair D., Kouforgiorgos T. and Papantoniou B. J., Contact metric manifolds satisfying a nullity condition, Israel J. Math., 91 (1995), 189-214.

[5] Boeckx, E., A full classi cation of contact metric (k;µ)-spaces, Illinois J. Math., 44 (1) (2000), 212-219.

[6] Koufogiorgos, Th.and Tsichlias, C., On the existence of a new class of contact metric manifolds, Canad. Math. Bull., 43 (2000), 440-447.

[7] R.S. Hamilton, The Ricci flow on surfaces, `Mathematical and General relativity (Santa Cruz, CA, 1986)', American Math. Soc. Contemp. Math. 71 (1988), 237—262

[8] R. Sharma, Certain results on K-contact and (k,μ) -contact manifolds, J. Geom. 89 (2008), 138–147.

Weak semi-local functions in ideal topological spaces

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ABSTRACT

Ideals, ideal topological spaces and local functions were discussed for many years in many papers. Various concepts were defined and the relationships between them are examined. Kuratowski gave the concepts of ideals and local functions for the first time (Kuratowski 1933). He examined the properties of local functions and he also gave axioms to obtain a new topology. Those axioms are called "Kuratowski Closure Axioms". Vaidyanathaswamy obtained a new topology by the help local function and Kuratowski Closure Axioms (Vaidyanathaswamy 1945). Jankovic and Hamlett have presented concept of ideal topological space (Jankovic and Hamlett 1990). They obtained some new results and some applications. Khan and Noiri gave definition of semi-local functions by using semi-open sets (Khan and Noiri 2010) . They also expolored the properties of semi-local functions. An approximation of the local function has been given by help of closure operator of the topological space (Al-Omari and Noiri 2013). Islam and Modak presented "semi-closure local function" (Islam and Modak 2018). They have introduced another approximation of the local function by the help of semi-closure.

In this study, we defined a new local function which is called " weak semi-local function" . We also expolored the properties of this weak semi-local function and obtained new results.

Key Words: Ideal topological spaces, Local function, Weak semi-local function

MSC : 54

REFERENCES

[1] Kuratowski, K, Topologie I, Warszawa, 1933.

[2] Vaidyanathaswamy, R., The localization theory in set-topology, Proc. Indian Acad. Sci. Studies 20,51-61, 1945.

[3] Janković, D. and Hamlet T.R. , New topologies from old via ideals, Amer. Math. Monthly, 97, 295-310, 1990.

[4] MD. Monırul Islam and Shyamapada Modak , Second approximation of local functions in ideal topological spaces, Acta Et Commet. Uni. Tartu. De Math. 22(2), 2018.

[5] A. Al-Omari and T. Noiri, Local closure functions in ideal topological spaces, Novi Sad J. Math. 43(2), 2013.

[6] M. Khan and T. Noiri, Semi-local functions in ideal topological spaces, J. Adv. Res Pure Math. 2(1) , 36–42, 2010.

On $IH_S/\mathbb{Z}_p$ split quaternions algebra

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ABSTRACT

A $q = a_0e_0 + a_1e_1 + a_2e_2 + a_3e_3$ real quaternion, with four real numbers, a_0, a_1, a_2, a_3, having properties of

$$\begin{aligned}
&e_1^2 = e_2^2 = e_3^2 = -1,\\
&e_1 \times e_2 = e_3,\ e_2 \times e_3 = e_1,\ e_3 \times e_1 = e_2,\\
&e_2 \times e_1 = -e_3,\ e_3 \times e_2 = -e_1,\ e_1 \times e_3 = -e_2
\end{aligned}$$

and four units, $e_0 = 1, e_1, e_2, e_3$, was defined by Irish mathematician Sir William Rowan Hamilton in 1843. All real quaternions, being extensions of four dimensional complex numbers, of IH, $\{IH, \oplus, \mathbb{R}, +, \cdot, \odot, \times\}$ system is a quaternion algebra. By defining quaternions, Hamilton, showed that division is possible for two vectors, hence, adding a new multiplication to vector algebra. By this new definition of multiplication of quaternions, it became easier to examine movements in Euclidean space (Hacısalihoğlu 1983).

In this study, fundamental definitions and operations of split quaternions are explained, where algebraic structure of split quaternions were built by using an object obtained from prime numbers. Quaternion multiplication of split quaternions is explained as defined in (Aristidou 2009) by using the object obtained from prime numbers, and in turn, by the help of a linear operator, it is expressed as a matrix multiplication. It has been observed that those matrix multiplication operators are similar to those Hamilton operators given by (Agrawal 1987). Thus, algebraic structure of split quaternions is built on the object founded by prime numbers and properties of such quaternions are examined.

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Key Words: Quaternion, quaternion algebra, split quaternion algebra.

MSC : 15A33, 20H25, 11R52.

REFERENCES

[1] O.P. Agrawal, Hamilton operators and dual number-quaternions in spatial kinetics, Mechanisms and Machine Theory, Vol.22 (1987) 569-575.

[2] Adler, J.E. Coury, The Theory of Numbers, Jones and Bartlett Publishers, Boston, 1995.

[3] H.H. Hacısalihoğlu, Motion Geometry and Quaternions Theory, Gazi University Faculty of Arts and Science Publications, Mat. No. 2, p.338, Ankara, 1983.

[4] M. Aristidou, A note on quaternion rings, International Journal of Algebra, Vol.3 No.15 (2009)

[5] 725-728.

[6] J.A. Gallian, Contemporary Abstract Algebra, 8th Ed., Boston, 2013.

[7] L. Kula, Split Quaternions and Geometrical Applications, Ankara University Institute of Science Ph. D. Thesis, Ankara, p.116, 2003.

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Investigation of a proving process in the context of the proof image, the epistemic actions and the enlightenment

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ABSTRACT

Proving activities have great significance in learning and teaching of advanced mathematics subjects (Weber, 2001). Thus, developing this ability is one of the main objectives of several courses. While the importance of proving in mathematics education has been emphasized, there are few studies in literature examining this process moment-by-moment. In addition, many studies show that undergraduates have difficulties (such as conceptual, representational and methodical) on this matter. To overcome mentioned difficulties, many theoretical frameworks have been presented from different perspectives. Being one of them the proof image was introduced by Kidron and Dreyfus (2014) by correlating different frameworks, which explain the learning process of individuals. While introducing this framework, they RBC (Recognizing – Building With - Constructing) model as a tool. Proof image provides a suitable context both for analyzing the interaction between formal constructs and intuitive constructs in proving and for tracing forming stages of the "new" construct emerging this interaction. Because it was aimed to understand how to the proving process forming and what are the components that it included, the proof image was adopted as the theoretical perspective of this study.

In this descriptive study, which is a part of larger study, criterion-sampling method was used, and a junior level prospective teacher (named as M) was selected. This participant was asked to prove following theorem:

Theorem: The set of real numbers ($\mathbb{R}$) is equivalent to its each subset, which includes an open interval.

Due to its nature, which allows interactions between intuitive and logical constructs (Kolar and Čadež, 2012; Tsamir, 1999), the infinity was preferred as the

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context of the study and the participant was expected to use Cantor's bijective mapping approach. Right after the proving activity, a semi-structured interview performed. Two cameras from different angles recorded all of these activities. Transcription documents, video recordings and written answers of the participant were examined together in the data analysis process. As a result of the cognitive and affective analyses, it was identified that M had a proof image. In addition, insight moments and enlightenment were identified as the important steps, which carried him to formal proof.

The results related to the proof image, the insight moments and the enlightenment will be discussed in detail in the presentation.

Key Words: Proof, Cantorian set theory, proof image.

MSC: 97.

REFERENCES

[1] Weber, K. (2001). Student difficulty in constructing proofs: The need for strategic knowledge. *Educational studies in mathematics*, *48*(1), 101-119.

[2] Kidron, I. & Dreyfus, T. (2014). Proof image. *Educational Studies in Mathematics*, *87*(3), 297-321.

[3] Kolar, V. M. & Čadež, T. H. (2012). Analysis of factors influencing the understanding of the concept of infinity. *Educational Studies in Mathematics*, *80*(3), 389-412.

[4] Tsamir, P. (1999). The transition from comparison of finite to the comparison of infinitesets: teaching prospective teachers. *Educational Studies in Mathematics*, 38, 209– 234.

Concept of arithmetic mean in Turkish and Singaporean mathematics textbooks

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ABSTRACT

Arithmetic mean is one of the important concepts we come across in daily life and statistics. In daily life, the concept of arithmetic mean is used in various fields like meteorology, medicine and agriculture (Zazkis, 2013). Although arithmetic mean seems to be a simple concept, studies show that secondary and high school students experience various difficulties regarding this concept (Strauss and Bichler, 1988; Mokros and Russell, 1995; Cai, 2000). Finding the arithmetic mean of a dataset via algorithm does not indicate students' comprehension of the arithmetic mean concept. Students should know where the arithmetic mean algorithm comes from, why it is used and should be able to find the missing data over the mean value in a known dataset (Cai, 2002). Students should know the properties of arithmetic mean and should be able to use it effectively to compare datasets (Gal, Rothschild and Wagner, 1989).

Results of international comparison studies reveal that Singaporean students are more successful than Turkish students in problems related to arithmetic mean. The difference between the performances of the Singaporean and Turkish students can be explained by examining how this concept is presented in textbooks and what kind of problems are included. Since textbooks are the main source used by teachers in their courses, they affect what and how to teach and what kind of problems they will ask students. In this study, to reveal the difference between the performances of Singaporean and Turkish students in the problems related to arithmetic mean, Singapore and Turkish textbooks were compared for learning opportunities they provided to students in terms of the arithmetic mean concept.

The findings reveal that the concept of arithmetic mean is thought at the sixth grade in Turkey and fifth grade in Singapore. While calculating the arithmetic mean of a dataset in Turkish textbooks, the rule "sum the elements of the dataset and divide it

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into data number" is directly given but solutions and explanatory examples regarding what this rule means and why it is used are not included. On the contrary, in the Singaporean textbooks, the rule is not directly given but modeled by using visual representations and the rule "sum the elements of the dataset and divide it into data number" is created addressing the equal division meaning. Besides, it was determined that the properties of arithmetic mean are not included in the textbooks of both countries sufficiently. In Singaporean textbooks, the emphasis is only laid on whether the mean is a value between the biggest and smallest element in the dataset, but Turkish textbooks specify that the mean will increase when a value bigger than the mean is added and decrease when a value smaller than the mean is added to the dataset. The findings put forward that the content of the Turkish textbooks should be organized in a way that students can learn the arithmetic mean algorithm significantly (Russell and Mokros, 1996). Furthermore, the textbooks of both countries should be enriched with contents enabling students to deeply learn the properties of the arithmetic mean.

Key Words: Arithmetic average, Turkish and Singaporean mathematics textbooks, Instructional content

MSC: 97D10

REFERENCES

[1] J. Cai, Understanding and representing the arithmetic averaging algorithm: an analysis and comparison of US and Chinese students' responses. International Journal of Mathematical Education in Science and Technology, 31(6), 839-855, 2000.

[2] J. Cai, J. J. Lo, T. Watanabe, Intended treatmens of arithmetic average in U.S. and Asian School mathematics textbooks. School Science and Mathematics, 102(8), 391-404, 2002.

[3] I. Gal, K. Rothschild, D. A. Wagner, Which group is better?: The development of statistical reasoning in elementary school children. Paper presented at the meeting of the Society for Research in Child Development, Kansas City, MO, 1989.

[4] J. Mokros, S. J. Russell, Children's concepts of a average and representativeness. Journal for Research in Mathematics Education, 26(1), 20-39, 1995.

[5] S. J. Russell, J. Mokros, What do children understand about average? Teaching Children, 2(6), 360-364, 1996.

[6] S. Strauss, E. Bichler, The development of children's concept of the arithmetic average. Journal for Research in Mathematics Education, 19(1), 64-80, 1988.

[7] J. M. Watson, The role of cognitive conflict in developing student's understanding of average. Educational Studies in Mathematics. 65, 21-47, 2007.

[8] D. Zazkis, On students' conceptions of arithmetic average: the case of inference from a fixed total. International Journal of Mathematical Education in Science and Technology, 44(2), 204-213, 2013.

The effect of history of mathematics activities on the development of mental computation skill of seventh grade students

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ABSTRACT

Mathematics began with arithmetic calculations for meeting the needs of people in daily life (Erdem, Duran and Gurbuz, 2011). Many students achieve the result of operation by writing the numbers one under the other or side by side with a specified rule and traditional algorithms. Students should be enabled to think flexibly, to create different methods by reasoning for they can achieve the result without needing paper-pen and these algorithms in calculations (Sengul and Dede, 2014). In this regard, the skill of mental computation performing by using various strategies in calculations is among the primary goals in the curriculum of math course (Ministry of National Education [MNE], 2017). When the methods of those days, in which the four operations that began to occur with the contribution of ancient civilizations were dominant, are used in classes, the calculations of theoretical mathematics may be made more meaningful for students (Erdem, Duran and Gurbuz, 2011). This study aimed at determining the effect of mathematics history activities on the development of mental computation skill of seventh-grade students. This research was designed as action research from qualitative research methods. Action research, in which the researcher is itself in the research process and takes an active role in uncovering or removing the problems occurred in practice, is one of the qualitative research methods (Yildirim and Simsek, 2018). The participants of the study consisted of 19 seventh grade students receiving education in a secondary school and one mathematics teacher. The data gathering tools included observation form of mental computation, structured interviews made with students, field notes taken by the teacher and study papers of mathematics history administrated to students. Observation Form of Mental Computation (OFMC) was performed to the seventh-grade students before implementing mathematical activities. Next, totally 10 hours of

mathematics activities were applied to students for five weeks as two lesson periods per week. After all the activities were applied, OFMC was re-administered to the seventh-grade students and their opinions on the history of mathematics were taken. Descriptive and content analysis methods from qualitative data analysis methods were used in the analysis of the data obtained from the study.

It was observed as a result of the study that activities of mathematics history developed the mental computation skills of seventh grade students in adding three and four-digit numbers, in subtracting two and three-digit numbers, in multiplying two numbers, one of which is two and the other is one-digit numbers, in dividing two and three-digit numbers into one-digit numbers. In addition, it was also detected that the activities of mathematics history contributed to the enrichment of operation strategies of the seventh-grade students. What is more, the seventh-grade students and the teacher, who participated in the study, expressed that the activities of mathematics history had positive aspects such as operation practicability, positive attitude towards mathematics, transferring into daily life. However, the activities of mathematics history were also indicated as difficult by students.

Key Words: History of mathematics, mental computation, mathematics education.

MSC: 97

REFERENCES

[1] Erdem, E., Gürbüz, R., & Duran, H. (2011). On the mathematics used in daily life from past to present: Practice not theoretical. Turkish Journal of Computer and Mathematics Education (TURCOMAT), 2(3).

[2] Republic of Turkey Ministry of National Education (MEB) (2017). Mathematics curriculum (1, 2, 3, 4, 5, 6, 7 and 8. Classes). Ankara.

[3] Şengül, S., Dede, H. G. (2014). The strategies of mathematics theachers whwn solving number sense problems. Turkish Journal of Computer and Mathematics Education (TURCOMAT), 5(1), 73-88.

[4] Yıldırım, A. and Şimşek, H. (2011). Qualitative research methods in the social sciences (8. baskı). Ankara: Seçkin Publishing.

Comparison of two student groups in the skills of transformation of the verbal questions to mathematical language

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ABSTRACT

In this study; it is investigated that what methods are used and whether these methods are used correctly while transforming the verbally given mathematical problem into mathematics. In this research the comparison of two groups of students in the 6th grade of secondary school was carried out. While selecting this group of students, two of the secondary schools in Iğdır province were selected. One of these schools consists of students from parents who have middle-high socio-economic status, living downtown and generally are public officials, while the other consists of students from parents who have socio-economic status with low incomes, living uptown and generally are tradesmen and socio-economic status with low incomes.

Form of Determining Students' Strategies and Errors to Solve Algebraic Verbal Problems which was used by Lee and Chang, Van Ameron; Akkan, Baki and Çakıroğlu and developed by Bal and Karcıoğlu , is used as a data collection tool. (Lee and Chang 2012, Ameron 2002, Akkan, Baki and Çakıroğlu 2012, Bal and Karcıoğlu 2017) The answers of the students who were asked 5 open-ended questions to 30 students from both schools were examined by means of SPSS package program, Arithmetical Reasoning, Pre-Algebraic Reasoning and Algebraic Reasoning were examined. At the end of the study, it was determined that the level of skill of the sixth grade students in algebraic verbal problems was not desirable in order to decide the correctness of the result and the solution, to make logical discussions about the solution, to solve the verbal problem, to generalize and to determine the appropriate reasoning and to use. It was observed that parents' level of education and high socio-economic status contributed to the success of the student. Problem solving and reasoning should be given more importance in mathematics curriculum. Math teachers need to teach their students to write algebraic expressions appropriate to a given situation and to write a verbal case suitable to a given algebraic expression. It is necessary to comprehend by

students how algebraic expression takes value and how it is calculated for different natural number values. it should be told to students how to explain the meaning of simple algebraic expressions.

Key Words: Verbal questions, ability to convert to mathematical language, algebraic solutions

MSC: 97

REFERENCES

[1] P. A. Bal, A. Karcıoğlu, The anlysis of mistakes and solution strategies applied in algebraic verbal problems: secondary sample, Çukurova University Institute of Social Sciences, 26 (3), 313-327, 2017.

[2] Y. Akkan, A. Baki, Ü. Çakıroğlu Examination of the 5^{th}-8^{th} grade students' transition Process From Arithmetic to algebra with regard problem solving. HacettepeJournal of Education, 43, 1-13, 2012.

[3] B. Van Amerom Reinvention of early algebra: Developmental research on the transition from arithmetic to algebra. Unpublished doctoral dissertation, University of Utrecht, Netherlands, 2002.

[4] H. Lee and K. Chang Elementary student's algebraic reasoning abilities in mathematics problem solving, 12th International Congress on Mathematical Education, July 8-15, COEX, Seoul, Korea., 2012.

The effect of mathematics history activities on the development of quantitative reasoning skill of seventh-grade students

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ABSTRACT

Quantitative reasoning is the skill of using quantitative structures such as counting, part-whole, ratio in understanding and solving a problem (Thompson, 1993). Ancient civilizations have used many different methods to express four operations and fractions throughout the history of mathematics (Erdem, Duran and Gurbuz, 2011). In this regard, the explanatory-confirmatory research design from mixed research designs was used in this investigation for the purpose of determining the effect of mathematics history activities on the development of quantitative reasoning skill of seventh-grade students. Quantitative data are firstly obtained in explanatory-confirmatory research design. Qualitative data are gathered in the following stage so as to make quantitative data more significant (Creswell, 2011). Quasi-experimental research design was used in the quantitative part of this study. In the qualitative part of the study, case study was used. Seventh grade students' opinion about history of mathematics was our case in this study. The sample of study consists of 41 seventh grade students receiving education in a secondary school located in the Central Anatolia Region in Turkey. There are 8 female and 12 male students in the experimental group and 11 female and 10 male students in the control group. The real names of students were not used within the frame of ethical principles of the study. In this respect, students in the experimental group were given codes from T1 to T20 and students in the control group were given codes from C1 to C21. "Mathematical Reasoning Test (MRT)" developed by Erdem (2015) was used in the quantitative part of this study for the purpose of measuring the mathematical reasoning skills of seventh-grade students. Interview form prepared by the researchers was used as data gathering tool in the qualitative part of the research and the opinions of students about the application were taken through written form. Independent t-test was used to compare the quantitative reasoning skills of seventh-

grade students. The opinions of students about the history of mathematics were analyzed by means of content analysis from qualitative data analysis methods.

Although there was no statistically significant difference between the quantitative reasoning test scores of the experimental and control group students at the end of the study, the quantitative reasoning skills of the experimental group developed more than the control group students'. What is more, the seventh-grade students, who participated in the study, stated that activities of mathematics history have positive aspects such as developing a different point of view to problems, solving problems faster and developing logical thinking. On the other hand, some students stated that mathematical history activities were sometimes difficult and complex.

Key Words: History of mathematics, quantitative reasoning, mathematics education.

MSC: 97

REFERENCES

[1] Creswell, J. W. (2011). *Educational research: planning, conducting, and evaluating quantitative and qualitative research* (4th Ed). Pearson Publications,Inc.

[2] Erdem, E. (2015). *The effect of enriched learning environment on mathematical reasoning and attitude* (Doctoral dissertation). Ataturk University, Erzurum.

[3] Erdem, E., Gürbüz, R., & Duran, H. (2011). On the mathematics used in daily life from past to present: Practice not theoretical. Turkish Journal of Computer and Mathematics Education (TURCOMAT), 2(3).

[4] Thompson P. W. (1993). Quantitative reasoning, complexity, and additive structures. Educational Studies in Mathematics, 25 (3), 165-208

Evaluation of mathematics textbooks in the concept of creativity and comparison of some countries

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ABSTRACT

Nowadays, there is a need for individuals who can produce ideas that can adapt these ideas to different areas. In this context, creativity in education emerges as an important concept. Creativity is seen as a humane and social feature that encourages humanity to progress through history (Leikin & Pitta-Pantazi, (2013). One of the main educational purposes of the countries is to educate individuals who think creatively as stated in the Mathematics curriculums. Some of the characteristics of the creative individual are stated as accuracy, curiosity, intuition, tolerance to uncertainty, persistence, openness to experience, wide interests, independence and open-mindedness (Leikin & Pitta-Pantazi, (2013) The use of creative problems in mathematics teaching will not only improve the thinking process, but will also increase students' motivation and interest. (Bishara, 2016). While this kind of problems develop students' creativity, they also make contribution to their abilities such as exploring, considering a problem as a whole, producing their own techniques or changing techniques given to them, listening and discussing, defining goals and team collaboration. Students must be active, discovering and experimenting, guessing and analysing, and seeing their own mistakes. (Meissner, 1999)

The aim of the study is to evaluate the fourth grade mathematics textbook that is taught by the Ministry of National Education in 2018-2019 in terms of creativity concept and compare it with the textbooks of some other countries. For this purpose, the comparison of the mathematics textbooks in Turkey, Singapore and Russia in terms of creativity concept was made. An evaluation form consisting of 29 items was developed for this purpose.

Turkish, Singaporean and Russian textbooks evaluated within the framework of the concept of creativity. The data were analysed by using descriptive statistics techniques. The findings show that creativity is not adequately addressed in the textbooks. It was observed that the available activities in the books, which are limited, do not emphasize creativity adequately. Detailed results will be presented at the conference.

Key Words: Mathematical creativity, creative mathematical problems, mathematics textbooks.

MSC: 65, 68.

REFERENCES

[1] Bishara, S. (2016). Creativity in Unique Problem-Solving in Mathematics. Cogent Education, c.3.

[2] Leikin, R., & Pitta-Pantazi, D. (2013). Creativity and Mathematics Education: The State of The Art. ZDM Mathematics Education, s.45 159-166

[3] Meissner, H. (2006). Creativity and Mathematics Education çev. Hülye Gür, Mehmet A. Kandemir. İlköğretimonline.c.2 s.1: 65-72

A research on the role of creative drama in mathematics learning

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ABSTRACT

With the emergence of human-centered, self-directed and empirical learning power, innovations in education have led to the emergence of the concept of child-centered education. Thus, activities based on children's games have been given importance and it has become widespread to give activities in which students are more active. In parallel with the developments, student-centered practices based on creative drama have begun to take its place in our country and are visible in the curriculum and classroom applications. The reflection of drama activities into practice began in the 1990s and has been included in the education system with the elective drama courses at the faculties of education and in schools affiliated with the Ministry of National Education. Especially in primary schools, drama activities have become used in courses. The use of creative drama is especially important in schools and classroom settings. Students learn the situations in their lives by doing creative drama method with experiencing their creativity and observations. So they prepare them for life. They learn how to find effective solutions and to express themselves. Furthermore, they may realize that there are different ways of learning.

Therefore, the aim of this study is to investigate the effects of creative drama supported mathematics curriculum on mathematics achievement and problem solving strategies of elementary school students. For this aim, some creative drama activities have been planned and developed for mathematics lesson. The activities performed with the students. A test has been used to observe students achievement. The test results also used to compare the level of achievements. Observations, video recordings and conversations between students have been used to understand the details. All possible findings will be presented at the conference.

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Key Words: Creative drama, mathematics achievement, student-centered activities.

MSC: 97.

REFERENCES

[1] Masoum, E. and Meskhi, A. (2013). A Study on the Role of drama in learning mathematics, Mathematics Education and Trends. 2013 (2013) 7-11.

[2] Chaviaris, P. Kafoussi, S. (2010). Learning mathematics with creative drama (JIBA) 5 (2) (2010) 91-110.

Giftedness and spatial thinking: a qualitative case study

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ABSTRACT

Spatial thinking entails the ability to create a mental representation of an object and manipulate it in the new mental processes (Kosslyn and Osherson, 1995) Most of the researchers agree that spatial thinking is important in mathematics education because intuitive perspective and insight are crucial capabilities that the students need to succeed in many areas of mathematics (Usiskin,1982). The ability to form mental representation of mathematical object and to transfer this to new situation is accepted as an indicator of mathematical giftedness (Krutetskii, 1976). This process requires intense cognitive efforts and it is for this reason spatial thinking is considered to be an indicator of giftedness (Gardner,1983). This study aims to investigate approaches and strategies that the gifted students employed in solving the problems that request spatial thinking. Based on the research findings this study brings suggestions concerning as to the quality of classroom teachings and the instructional materials that the gifted students are provided.

The study employed a qualitative method in order to examine the research case from the perspective of participants and with a holistic approach (Yin, 2003). The participants included 191 secondary school students (52 gifted students and 139 non-gifted students). Gifted students were following complementary courses provided by Science and Art Centers in Kayseri. Non-gifted students were selected from four different schools in the same city and these school are deemed to be successful institutions by the educators. Data were obtained from questionnaire and semi-structured interviews. The questionnaire included 15 tasks. These tasks were partitioned in three equal parts and the tasks in each part aimed to reveal different aspects of students’ spatial reasoning, namely spatial visualization, spatial relation and spatial orientation abilities. Qualitative data were obtained from semi-structured interviews conducted with ten students (five from each group). Descriptive analysis of

quantitative data was carried in SPSS program. Qualitative data were analyzed using content and discourse analysis methods (Miles and Huberman, 1994).

The research findings indicated that gifted students are more successful than their peers in solving problems in three sub-domains of the spatial thinking, namely spatial visualization, spatial relations and spatial orientation. In fact, the differences between gifted and non-gifted students is grounded in the quality of their thinking processes. Non-gifted students displayed procedural approaches in that they utilized points of references or physical aspects of geometrical figures and carried out the solution process in a step by step manner. On the other hand, gifted students employed visual approaches. They constructed mental structures of the given objects in their minds and, then, used these objects as a single mathematical entity in the solution processes. Also, in solving the given problems gifted students displayed more flexible thinking and capitalized upon other strategies and notions, such as functional thinking, pattern searching and the notion of symmetry.

Key Words: Gifted students, non-gifted students, spatial thinking, spatial visualization, spatial relation, spatial orientation.

REFERENCES

[1] Gardner, H., Mind Frames Multiple Intelligence Theory, (Translated by E. Kılıç), Alfa Publishing: Ankara, 559s. 1983.

[2] Kosslyn, S. M. Mental imagery. In S. M. Kosslyn & D. N. Osherson (Eds.), Visual cognition: An invitation to cognitive science (Vol. 2, pp. 267-296). Cambridge, MA: MIT Press. 1995.

[3] Krutetskii, V. A. The psychology of mathematical abilities in schoolchildren. Chicago: The University of Chicago Press. 1976.

[4] Miles, M. B., & Huberman, A. M. Qualitative data analysis: An expanded source book (2nd ed.). Thousans Oaks, CA: Sage Publication. 1994.

[5] Usiskin, Z., “Resolving the continuing dilemmas in school geometry”. In M. M. Lindquist and A. P. Shulte (Eds), Learning and Teaching Geometry, K-12. Reston, VA, National Coucil of Teachers of Mathematics. 1987.

[6] Yin, R. K. Case study research: design and methods (3rd ed.). Thousand Oaks, CA: Sage. 2003.

The investigation of the relationship between number sense and algebraic thinking skill

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ABSTRACT

Number sense is one of the basic skills in mathematics because numbers are in every area of our lives. The sense of number is defined as the flexibility and fluency in the numbers, the understanding of the meaning of numbers, the ability to make mental mathematics and compare (Gersten and Chard, 1999).

To being understood of the relationship between number sense and another important skills; it provides a better understanding of the subject and provides guidance on how to develop number sense in students. It is important that teachers know the skills that students have and how they relate to these skills. Another way of thinking that involves basic skills for mathematics is algebraic thinking. The purpose of this study; to evaluate the relationship between number sense and algebraic thinking levels by determining the number sense and algebraic thinking levels of secondary school 7th and 8th grade students.

Exploratory correlational method among the relational research methods were used in this study. In the fall semester of the 2018-2019 academic year, 330 students attending 7th and 8th grade in two secondary schools in the province of Konya were participated in the research.

In the research, to determine the algebraic thinking levels of students, developed by Hart et al. (1998) and "Algebraic Thinking Test" adapted to Turkish by Altun (2005) was used. In addition, 'Number Sense Scale' developed by Kayhan and Umay (2013) was used as a data collection tool in order to determine the number sense of the students. The scores obtained from the number sense and algebraic thinking test were analyzed quantitatively.

At the end of the research, it was seen that the number sense score averages of the students is quite low. It was determined that students solved the questions in that should use number sense by using rule based ways. While there is no statistically meaningful difference between number sense and grade level, it was found that there is a meaningful relationship between number sense and algebraic thinking in favor of female students. According to the results of the algebraic thinking test, it was observed that both the 7th grade and 8th grade students experienced an accumulation in the level 0 and level 1. At level 0 and level 1, it was observed that there are more students in 7th grade and more students in level 2, 3 and 4 than 8th grade. In addition, a significant difference was found between level of algebraic thinking and gender and grade level. Finally, it was determined that there is a strong relationship between students' number sense and algebraic thinking level in the positive direction. In addition it was found that 49% of total variance of algebraic thinking could be explained by the number sense.

Key Words: Number sense, algebraic thinking level, 7th and 8th grade students.

MSC: 97.

REFERENCES

[1] M. Altun, Teaching Mathematics in Secondary Education. Bursa: Alfa Publishing, 2005.

[2] R. Gersten, D. Chard, Number sense: Rethinking arithmetic instruction for students with mathematical disabilities, The Journal of special education 33 (1) (1999) 18-28.

[3] K.M. Hart, M.L. Brown, D.E. Kuchermann, D. Kerslach, G. Ruddock, M. Mccartney, Children's understanding of mathematics: 11-16, General Editor K.M. Hart, The CSMS Mathematics Team, 1998.

[4] M. Kayhan Altay, A. Umay, The Development of Number Sense Scale towards Middle Grade Students, Education and Science, 38 (167) (2013) 241-255.

An investigation into some variables affecting mathematics achievements of secondary school students

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ABSTRACT

The factors affecting mathematical academic achievement and the predictive variables of it have been among interesting topics for the researchers for a long time (Dursun and Dede, 2004; Üredi and Üredi, 2005; Özer and Anıl, 2011) . The problem solving, which is thought to play an important role in the development of academic achievement related to mathematics, draws attention as a skill that has gained importance in recent years both in the international examinations and in the report of the National Council of Teachers of Mathematics (NCTM) principles and standards. In this study, which was conducted to estimate mathematics achievement with variables that could be related to both mathematics and problem solving, the relationship between mathematics achievement and problem solving skills and attitudes, attitudes towards mathematics, mathematics self afficacy, attitude towards mathematical problem solving and Kolb learning styles. The study group of this research, which is a descriptive survey model, was determined by appropriate sampling method. For this purpose, a total of 240 secondary school students who study in two secondary schools in a province located in the Mediterranean Region and who have participated in the study voluntarily were studied. The data collection tools used in the research are scale of skills and strategies for problem solving, att,itude towards mathematics scale, mathematics self-efficacy scale, attitude towards mathematical problem solving scale and Kolb learning styles scale. As the data analysis process of the research has not ended, the findings will be shared later. Based on the findings, future research and practical recommendations will be made.

Key Words: Attitude, learning style, mathematical self-efficacy, problem solving.
MSC : 65, 68.

REFERENCES

[1] Dursun, Ş. & Dede, Y. (2004). The Factors Affecting Students' Success in Mathematics: Mathematics Teachers' Perspectives, Gazi University, Journal of Gazi Educational Faculty *24*(2).

[2] Özer, Y. and Anıl, D. (2011). Examining the factors affecting students' science and mathematics achievement with structural equation modeling, *H.U. Journal of Education*, *41*(41), 313-324.

[3] Üredi, I., and Üredi, L. (2005). The Predictive Power of Self-regulation Strategies and Motivational Beliefs on Mathematics Achievement of Primary School 8th Grade Students, Mersin University Journal of the Faculty of Education, *1*(2), 250-260.

Middle school students' skills in mathematical modelling problems designed in different types of representation

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ABSTRACT

The aim of this study was to examine the development of middle school students' skills in mathematical modelling problems designed in different types of representations. In this research, Borromeo Ferri's (2006) framework which was modelling cycle under the cognitive perspective was chosen as the theoretical framework. And in this context cognitive modeling competences were dealt with as understanding, simplification, mathematizing, mathematical study, interpretation and validation skills. In addition, while modelling problems were developed, and the type of representation of the modeling problems was formed by the data obtained from the literature review (Maab, 2010). Maab (2010) discussed the type of mathematical representation in four different categories as represented by formal, graphical, table and verbal expressions. There are many studies on the development of modeling skills in the related literature. Because of the studies examining the development problems of modelling problems related to this classification are limited, the importance of the study is revealed.

The modeling-based learning process was applied to investigate mathematical modelling skills of middle school students with mathematical modelling problems with different types of representation. The problem of the research is expressed as; "Does the modelling skills of middle school students show significant differences in terms of mathematical modelling problems designed for different types of representation before and after the implementation?"

This research is a quasi-experimental study in order to examine the development of students' skills in mathematical modelling problems, which are designed in different types of representations. The study was designed according to single experimental

group with pre-test and post-test measurements. The study group consists of 20 students studying at 6th grade of middle schools in a big province.

In the study, mathematical modeling problems designed in four different types of representations developed by the researcher were used for pre-test and post-test. 8 mathematical modelling problems including different types of representations developed by the researchers were used in the learning process with mathematical modelling activities. The rubrics developed by Tekin Dede and Bukova Güzel (2014) were used to score mathematical modelling skills of the students. When evaluating with rubric, two different assessments were made to ensure reliability and the percentage of compliance was calculated as 94%. For data analysis, t-test was used for related samples and variance analysis was used for related samples.

As a result of the research, it was seen that there were significant differences all of the mathematical modelling problems which were designed in different types of representations in terms of students' understanding, simplification, mathematizing, and working mathematically skills. It can be said that there is no significant improvement in the validation and interpretation competences. As it is seen in this study, it is clear that students have the effect of transferring mathematics to their daily lives with different modelling problems. Different studies can be done examining the effects of modeling problems on students' daily lives. More comprehensive research can be done by developing mathematical modelling problems designed in different types of representations.

Key Words: Modelling problems, representation, secondary school students

MSC: 97.

REFERENCES

[1] K. Maab, Classification Scheme for Modelling Tasks, Journal für Mathematikdidaktik, 31 (2010), 285-311.

[2] R. Borromeo Ferri, Theoretical and Empirical Differentiations of Phases in the Modelling Process, Zentralblatt für Didaktik der Mathematik, 38(2) (2006), 86-95.

[3] A. Tekin Dede, E. Bukova Güzel, A Rubric Development Study for the Assessment of Modeling Skills. XI. National Science and Mathematics Education Congress, Adana, Türkiye, 11-14 September 2014.

Chocolate roulette: The use of mathematical games in the classroom

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ABSTRACT

Mathematical games include the features of real problems. They provide non-routine situations for students in which they can use their previously experiences. The games can also foster to the development of the following mathematical phases such as "trial and error methods, simplifying difficult tasks, looking for pattern, making and testing hypotheses, reasoning, proving and disproving" (Ernest 1986). Moreover, the games provide a high level of motivation for children. It allows to children make mistakes without fear, and to correct their mistakes.

Chocolate Roulette is a kind of nim game which is played by two people, depending on reducing a certain amount with same movements (Dufour and Heubach 2013). In chocolate roulette game, the opponents take rectangular parts from the main rectangular bar of chocolate (Figure 1). At the end of the game whoever takes the smallest part of chocolate on left down corner loses the game.

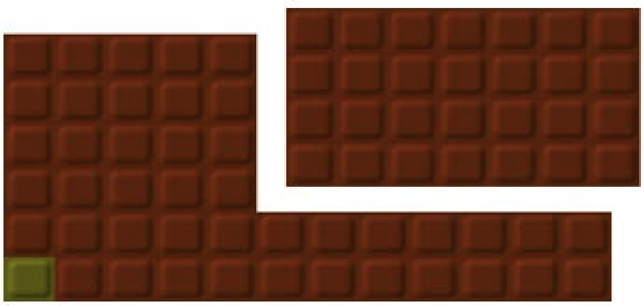

Figure 1: Chocolate roulette, an example movement

In this study, Chocolate Roulette game was played by 5th grade students and experienced mathematical process was presented. While playing the game, the students experienced the steps required for solution of a mathematical problem. Firstly, they endeavoured to understand the problem, secondly, made some trials, developed and tested their solutions. Then, they worked on the simplest examples of game (figure 2) and developed strategies on that examples to obtain a generalisation. Lastly, they shared final solutions with their friends.

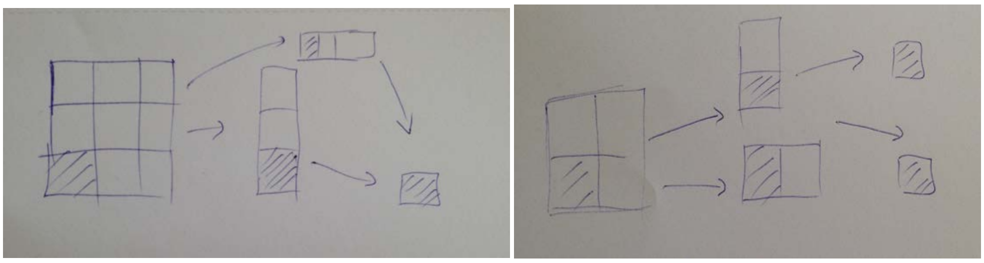

Figure 2: Examples of solution process (simplifying difficult tasks)

As a result of the study, it was observed that the students actively experienced most of the mathematical processes throughout the game. It was also concluded that games contributed to children's mathematical communication skills. During the mutual play, the children shared the solution phases with their friends and exchanged ideas. When the results of the other studies are considered (Ernest 1986, Ainley 1988), the mathematical games must be included in mathematics programs as long as they are carefully constructed and adapted.

Key Words: Mathematical games, problem solving skills, mathematical process

MSC: 97.

REFERENCES

[1] M. Dufour, S. Heubach, Circular Nim Games, The Electronic Journal of Combinatorics, 20 (2), 2013.

[2] P. Ernest, Games. A Rationale for Their Use in The Teaching of Mathematics in School. Mathematics in School, 15 (1986) 2-5.

[3] Ainley, J. Playing games and real mathematics. In D. Pimm (Ed.), Mathematics, Teacher and Children. Open University, 1988.

Analyzing the effect of argumentation based learning approach on students' argumentation willingness and discussion levels in triangles

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ABSTRACT

Argumentation is an individual activity that includes thinking and writing; and also a social activity that includes communication (Driver et al., 1998: 291).

People can make argumentation on different levels:

1. Individual: When designing an experiment or presenting an information.
2. Group: When giving an alternative direction to a research.
3. When computing claims on a conference etc.
4. When scientists computes their ideas using social media (Driver et al., 1998: 297).

Students listen each other and have alternative ideas on group working. They analyse the problem together, discuss the possible result and they reach consensus (Mercer, 1996: 363). Mercer summarize this process as follows:

- Students should express their ideas.
- Nobody should be dominant on the group, every students should be active.
- Students should clutch the aim of activity.
- Students should cooperate each other.

The purpose of this paper is to analyze the effect of teaching "Triangles" subject in mathematics classes through argumentation-based learning approach on students' argumentation willingness and their argumentation levels. Quantitative and qualitative datas was used in this research. The datas was gathered using one group pre-test post- test weak experimental research design. Experimental group consists of a total of 30 students studying at 9th grade of a high school in 2017-2018 educational year. A significant difference was identified between the statistics of pre-test and final test scores of Argumentation Willingness Scale. Moreover, outcomes of the study present that argumentation level of students is Level 2.

Key Words*:* Argumentation-based learning approach, scientific discussion, argumentation willingness, triangles.

MSC: 97

REFERENCES

[1] R. Driver, P. Newton, J. Osborne, Establishing the norms of scientific argumentation in classrooms. Science Education 84(3) (2000), 287-312.

[2] N. Mercer, The quality of talk in children's collaborative activity in the classroom, Learning and Instruction 6(4) (1996), 359-377.

Analyzing the effect of argumentation based learning approach in triangles in terms of different variables

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ABSTRACT

The new information coming up by social changes has affected our perspective on mathematics. Thus, discussion based learning system was focused instead of the information based learning system. So,

- Students can examine the events with causes and results.
- Students can observe the links between variables.
- Students can reach general situations using special situations.
- Students analyze and interpret the datas.
- Students associate Maths modeling and problem solving processes.
- Students explore new informations with existing informations.
- Students comment new information using mathematical language.
- Students can use information and communication technologies actively (MEB, 2013: I-II).

Toulmin has taken a new discussion model seeing lack of logical discussion approaches. According to Toulmin's discussion model, an argument has six item.

Claim: Results that you want to reach.

Data: The facts that supports claim.

Warrant: The general expression working as a bridge between claim and data.

Qualifier: The expression showing the power of warrant.

Rebuttal: The expression showing when claim is invalid.

Backing: The expression that strengthens warrant (Toulmin, 2003).

Argumentation based learning can improve students' success of science (Tekeli (2009)) and maths (Mercan (2015), Küçük Demir (2014)). Argumentation based learning can improve students' attitude of science (Oğuz Çakır (2011)) and maths (Mercan (2015)).

The purpose of this paper is to analyze the effect of teaching "Triangles" subject in Mathematics classes through argumentation-based learning approach on students' academic achievements, their attitudes to Mathematics, reflective thinking ability to solving problem and compare it with present teaching methods. Experimental group consists of a total of 58 students studying at 9th grade in two different classes of a high school in 2017-2018 educational year. The study data were collected via Triangles Achievement Test, Reflective Thinking Ability To Solving Problem Scale, Mathematics Attitude Scale. According to the outcomes if the study, a statistically significant difference on behalf of experimental group was identified between final test scores of Triangles Achievement Test, Mathematics Attitude Scale. However there is no statistically significant difference on control and experimental group between final test scores of Reflective Thinking Ability To Solving Problem Scale.

Key Words*:* Argumentation-based learning approach, scientific discussion, reflective thinking ability to solving problem, attitude to mathematics, triangles.

MSC: 97

REFERENCES

[1] B. Küçük Demir, The effect of the argumentation based science learning approach on students' mathematical achievement and skills of creative thinking, Ph. D. Thesis, Atatürk University, Institute of Educational Sciences, Erzurum, 2014 (in Turkish).
[2] MEB Secondary Mathematics Course Curriculum (9., 10.,11., 12. Classes), Ankara, 2013.
[3] E. Mercan, Analyzing the effect of argumentation-based learning approach in teaching functions in terms of different variables, Ph. D. Thesis, Atatürk University, Institute of Educational Sciences, Erzurum, 2015 (in Turkish).
[4] B.Z. Oğuz Çakır, The influence of argumentation based instruction on sixth grade students' attitudes toward science, conceptual understandings of physical and chemical change topic and argumentativeness, M. Sc. Thesis**,** Middle East Technical University, Institute of Social Sciences, Ankara, 2011.
[5] A. Tekeli, The effect of an argumentation-centered class environment on the conceptual change about acid-base and the understanding nature of science, M. Sc. Thesis, Gazi University, Institute of Educational Sciences, Ankara, 2009 (in Turkish).
S.E. Toulmin, The Uses Of Argument (updated edition). Cambridge University Press, 2003.

Analysis of mathematical achievements of students with and without preschool education and their attitudes towards mathematics based on the view of 1st grade teachers

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ABSTRACT

Preschool age includes the years when all developmental areas of the child are in a rapid change and progress. Children's learning experiences in this period develop a basis for the skills they will acquire in later years (Kıran, 2008). The required educational experiences that would allow preschool children to acquire certain behavioral patterns and support their development are developed by parents at home and by teachers in preschool education institutions. The development of children who could not benefit from these educational experiences is usually slow and children are destined to carry the traces of this negative condition throughout their lives (Aral et al., 2000). Furthermore, preschool education improves the development of the emotions and perception of the children. It helps the child in reasoning and causality processes. It helps the society to assimilate cultural values by educating the child in a social environment based on general cultural values (Şahin, 2004). Thus, the aim of the present study was to analyze mathematics achievement of children with and without preschool education and their attitudes towards mathematics based on the views of 1st grade teachers.

The interview technique, a qualitative research method, was used in the present study. The study population included 1st grade primary school teachers employed in Ministry of National Education primary schools in Diyarbakır province, Turkey during the 2018-2019 academic year. The study sample included 82 randomly selected classroom teachers from the above-mentioned population. A semi-structured interview form developed by the authors was used to collect the study data. The data collection instrument included six open-ended questions. Content analysis was used

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to analyze the data collected in the study. The data collected in the interviews were categorized via coding for use in content analysis. The data were classified under these categories and the responses of the teachers to the interview questions were reviewed in detail, and similar answers were included in the same category. The expressions in teacher statements were categorized into themes. Furthermore, the collected data are presented with direct quotes.

The study findings demonstrated that the students with preschool education had higher mathematics achievement and their attitudes towards mathematics course were more positive when compared to the students without preschool education. Furthermore, since preschool students' readiness, self-confidence, cognitive, psychomotor and language development skills were more advanced when compared to other students in the 1st grade mathematics course, it was observed that they were more interested and willing to answer questions, solve problems and produce creative solutions.

Key Words: Achievement, attitude, mathematics, preschool.

REFERENCES

[1] E. Şahin, Preschool Education, Ankara, Anı Publishing, 2005.

[2] N. Aral et all, Preschool Education and Kindergarten Programs, İstanbul, Ya-Pa Publishing, 2000.

[3] S. Kıran, Communication barriers in fairy tale and story books prepared for preschool children, Unpublished Master Thesis, Adnan Menderes University, Institute of Social Sciences, Aydın, 2008.

The impact of activities developed to reinforce learned concepts on mathematical achievements and permanence of learned knowledge of students

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ABSTRACT

Learning mathematics through activities could be considered as the main building stone in the learning process, since the students are expected to be mentally and physically active and engage in the learning process through learning activities. Therefore, it was considered important to develop adequate activities and implement them in the classroom environment in the learning-instruction processes (Özgen & Alkan, 2014). Thus, the present study aimed to investigate the impact of the activities developed to reinforce the learned concepts on mathematics achievement of the students and permanence of the learned knowledge.

The quantitative pretest posttest quasi-experimental design with study-control groups was used in the study. The study sample included 40 students (20 in the study and 20 in control groups) attending eighth grade in a public middle school located in Bağlar district in Diyarbakır province, Turkey during the 2018-2019 academic year. In the mathematics course, an activity named “Crossing the Street,” developed by Bell (1993) was implemented within the regular curriculum. The objective of this activity is to reinforce the student knowledge on multiplication and division of decimal numbers and integers. The activity could be conducted individually or with two teams. In the activity, each player selects two of the seven numbers presented in the main comb. Then the student would either multiply or divide these two numbers using a calculator. If the result is present in one of the combs, the student would put her or his cards on that comb. Thus, the first player or team to cross to the other side through linked combs would win the game. In the control group, only the program specified in the curriculum was implemented. The

study data was collected using an achievement test developed by the authors. The data were analyzed with SPSS (Statistical Package for Social Sciences) 24.0 software and the reliability coefficient of the test was determined as (Kuder-Richardson-20) 0.795. In data analysis, descriptive statistics, dependent and independent t-tests were utilized.

The study findings demonstrated that the activities developed to reinforce the learned concepts improved the mathematics achievement of the students and concurrently, allowed the students to retain their knowledge. Furthermore, it was observed that these activities did not lead to a significant difference between the mathematical achievements of the students based on the gender variable, however a significant difference was determined in permanence of the knowledge favoring the female students.

Key Words: Achievement, activity, concept, mathematics.

REFERENCES

[1] A. Bell, Principles for the design of teaching, Educational Studies in Mathematics, 24 (1) (1993) 5-34.

[2] K. Özgen, H. Alkan, Investigation of activity development skills of mathematics teacher candidates, Educational Sciences: Theory & Practice, 14 (3) (2014) 1179-1201.

New multimodal auxiliary function and directional search for global optimization

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ABSTRACT

The problem of finding the global minimizer of the unconstrained global optimization problem is defined as the following:

$$\min_{x\in\Omega} f(\mathrm{x})$$

where the objective function $f:\Omega\subset \mathrm{R}^n \to \mathrm{R}$ is a nonlinear continuous real-valued function and x is an n -dimensional vector of continuous variables. The domain of the search space Ω is defined by specifying upper (*ub*) and lower (*lu*) bounds.

The above optimization problem involves finding the best point x in Ω that gives the lowest value of the objective function f on Ω. In dealing with this optimization problem, one has to differentiate between two types of minimizers, local and global minimizers. A point $x_k^* \in \Omega$ is called a local minimizer of f on Ω if there exists $\varepsilon > 0$ such that $f(x) \le f(x_k^*)$, $\forall x \in \Omega$ and $\left\| x - x_k^* \right\| < \varepsilon$. On the other hand, a point $x^* \in \Omega$ is said to be a global minimizer of f over Ω if $f(x) \le f(x^*), \forall x \in \Omega$ (Ge and Qin 1987, Sahiner and Ibrahem 2019).

More and more effective problems in science, economics, engineering, and different fields can be expressed as global optimization problems. In recent years, many new theoretical and computational contributions have been reported for solving global optimization problems, see (Sahiner, Yilmaz, Ibrahem 2018, Sahiner, Yilmaz and Kapusuz 2019, Sahiner and Ibrahem 2019). In general, the existing methods can be classified into two categories: deterministic methods and probabilistic methods.

The filled function method is an efficient approach to find the global minimizer of multidimensional and one-dimensional functions. It has several advantages compared to other methods in consequence of its relatively easy implementation and finding better local minimizer.

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The filled function method has been developed quickly, however the numerical performance is not always satisfactory for global optimization as anticipated.

In this paper, we propose a new filled function, this filled function has been developed to tackle unconstrained global optimization problems. The aim of this filled function is to reduce the multi-dimensional function into a one-dimensional function and minimize it by using a directional search method. The efficiency and reliability of the new method are evaluated through numerical experiments using a large class of both simple and difficult test problems from the literature. The results indicate that the new method is much better than their original counterparts both in reliability and efficiency.

Key Words: Global optimization, directional search methods, auxiliary function.

MSC: 65, 68.

REFERENCES

[1] Y. Lin and Y. Yang, "Filled function method for nonlinear equations," Journal of Computational and Applied Mathematics, vol. 234, no. 3, pp. 695–702, 2010.

[2] R. P. Ge and Y. F. Qin, "A class of filled functions for finding global minimizers of a function of several variables," Journal of Optimization Theory and Applications, vol. 54, no. 2, pp. 241–252, 1987.

[3] R. P. Ge, "A filled function method for finding a global minimizer of a function of several variables," Mathematical Programming, vol. 46, no. 2, pp. 191–204, 1990.

[4] Y. Zhang, L. Zhang, and Y. Xu, "New filled functions for nonsmooth global optimization," Applied Mathematical Modelling, vol. 33, no. 7, pp. 3114–3129, 2009.

[5] E. K. Chong & S. H.Zak, An introduction to optimization. Vol. 76. John Wiley \& Sons, 2013.

[6] A. Sahiner, N. Yilmaz, S. A. Ibrahem, Smoothing Approximations to Non-smooth Functions, Journal of Multidisciplinary Modeling and Optimization 1 (2) (2018), 69-74.

[7] A. Sahiner, N. Yilmaz and G. Kapusuz, A novel modeling and smoothing technique in global optimization, J. Ind. Manage. Optim, 15 (1) 2019, 113-130.

[8] A. Sahiner, S. A. Ibrahem, A new global optimization technique by auxiliary function method in a directional search, Optim. Lett. 2019.

Students' views on pythagoras HTTM activity and application

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ABSTRACT

It is gaining importance to enable students to transfer and apply the knowledge they have learned to real-life situations in order to keep up with the ever-evolving and changing world. Therefore, different teaching processes are needed to develop these skills (Hıdıroğlu, 2018). Associating with other disciplines such as history of science, biology, physics and chemistry and making use of the theories in these disciplines can be effective in learning mathematical concepts. At the same time, the use of technology is effective in developing mathematical modeling skills. In this context, the HTTM (History / Theory / Technology / Modeling) activity, which includes the use of history of science, theory, technology and modeling in teaching environments, is developed with a holistic understanding (Hıdıroğlu & Özkan Hıdıroğlu, 2016) and reveals different mental structures in students. For this purpose, in our study, the efficiency of Pythagoras relation according to HTTM model which is a new teaching model was improved and the views of eighth grade students about the activity were examined. In our study, case study, one of the qualitative research method, was used. The study consisted of 4 volunteer students who were enrolled at the 8th grade in a public school of a district of province of Konya during the academic year 2018-2019. "Pythagoras HTTM activity" was designed by the researchers for this study. HTTM components were taken into consideration when designing the event and expert opinion was utilized. In the activity, the introductory video about Pythagoras life was presented to the students thereupon readiness questions were asked. After that, the students were asked to solve the problem situation which contains Pythagorean theorem. Geogebra program was used for the solutions of the students. It was also answered by the students in a question containing different types of mathematical

modeling. In the process, the activity attracted the attention of the students and it was observed that they participated actively. In order to determine the students' views about the activity, "student opinion form for teaching the course in accordance with HTTM model ” was presented and the students were asked to explain their opinions about the teaching process. Student opinions were analyzed by content analysis method. According to the results of the content analysis, the students stated that they found the activity enjoyable, that they liked it and that it was interesting that the issue had relevance to history. At the same time, they stated that they had a little difficulty at the beginning of the activity and later they became accustomed and they understood the subject better. The history of science, technology, theory and modeling used in the HTTM learning process helped students to create a different view of mathematics questions and the problems they face in daily life. It also enabled students to create high-level learning environments and was seen to be able to use technology in a more active and useful way.

Key Words: Pythagoras Theorem, Mathematical Modelling, HTTM.

MSC: 97.

REFERENCES

[1] Ç. N. Hıdıroğlu, Y. Özkan Hıdıroğlu, A Holistic Perspective on Modeling Approaches and Proposal for a New Learning Model: HTMM Model and Theoretical Basis (pp. 1110-1141), Pegem Akademy Publishing, 2016.

[2] Ç. N. Hıdıroğlu, HTTM (History/Theory/Technology/Modeling) High Level Mathematical Models in Learning Process. International EJER Congress 2018 Abstract Book (Pp. 1113-1115). Anı Publishing, 2018.

The relationship between pre-service elementary mathematics teachers' technological pedagogical content knowledge and mathematics teaching anxiety

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ABSTRACT

The main goal of this study is to investigate correlation between the mathematics teaching anxiety levels of pre-service mathematics teachers and their technological pedagogical content knowledge levels, and to find out whether or not these levels differ between gender, grade, department and age.

In this study, we have utilized correlational survey model as a quantitative research approach. The investigation has been conducted on 277 students who are studying at the 1st, 2nd, 3rd and 4th grades of mathematics teaching and primary education mathematics teaching departments in Necmettin Erbakan University, which is a state university in Turkey, Konya.

In this research, "Personal Information Form", "Technological Pedagogical Content Knowledge Scale (TPACK-Math)" (Önal 2016), and "Mathematics Teaching Anxiety Scale (MATAS)" (Peker 2006) have been used for collecting data.

The obtained information has been analyzed with SPSS 18 statistical software. In order to analyze this information, frequency (f) and percentage (%) analyses, Pearson Correlation Coefficient, Independent Samples t Test, Paired Samples t Test, One Way ANOVA, and Multiple Regression Technique have been used.

The results of the study revealed that there is no diversity between mathematics teaching anxiety averages for gender, department, grade and age variables. Although we found meaningful diversity for technology knowledge and content knowledge, which are subdimensions of technological pedagogical content knowledge, in favour of males; no meaningful diversity has been found in other subdimensions for gender variable. TPACK level of pre-service mathematics teachers didn't show meaningful diversity for department, grade and age variables.

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We also detected that there is an inverse, medium level and statistically meaningful relation between all subdimensions of Technological Pedagogical Content Knowledge Scale (TPACK-Math) and Mathematics Teaching Anxiety Scale (MATAS).

Key Words: Mathematics Teaching Anxiety, Technological Pedagogical Content Knowledge, pre-service teachers.

MSC: 97.

REFERENCES

[1] N. Önal, Development, Validity and reliability of TPACK scale with pre-service mathematics teachers, International Online Journal of Educational Sciences, 8 (2) (2016), 93-107.

[2] M. Peker, Developing Anxiety Scale for Mathematics Teaching, *Educational Sciences: Theory & Practice*, 5 (9) (2006), 73-92.

Social values in primary school mathematics textbooks

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ABSTRACT

One of the characteristics that separate people from other beings is that they have a system of values and make sense of life through these values (Küçükşen & Budak, 2017). The common behavioural patterns that need to be complied with in the society are determined by values (Yaman, Taflan & Çolak, 2009). Value is defined as an abstract measurement that is used to explain the significance of a thing, the correspondence of a thing, worth (TDK, 2018). The process of the individual to gain values starts with family and continues with school. The share of educational institutions in this important duty is great. Knowledge, skills, attitudes and values the individual gains through education constitute their character. It is clear that this will create changes in the societal structure (Topkaya, 2016). While schools prepare the student for life in the academic sense, they also aim to provide them with some values via curricular and extracurricular activities (MEB, 2017). Values are not considered to be a separate element in the curricula of the Turkish Ministry of National Education, and they are included in all units of the curricula (MEB, 2017). In the context of the targeted outcomes of curricula, one of the tools that are used in schools to provide values is textbooks (Gül, 2017). Social values are defined as the basic judgments and values that get the members of the society closer, keep them together and ensure the continuity of the society (TDK, 2018).

Some believe that mathematics is a field that does not involve values. However, mathematics also carries values (Dede, 2007). It would be wrong to think that mathematics and values are unrelated, and the place and significance of values education in mathematics are clear (Bishop, 1999). For the purposes of the study, we examined how social values are included in mathematics textbooks based on class levels and learning areas. This study used the qualitative method of case study with the purpose of investigating the social values included in primary school textbooks. The most important advantage of the case study method is that it provides the opportunity to conduct an in-depth analysis of a case, situation, relationship or

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process with the help of a limited sample (Denscombe, 2010). In the data collection process in this study, the qualitative data collection method of document analysis was preferred. In this context, the primary school mathematics textbooks, which are included on the website *www.eba.gov.tr* of the Ministry of National Education that provides electronic documents for teachers, were examined. The social values that are included in these primary school mathematics textbooks were analysed with the qualitative data analysis method of descriptive analysis. After the data were collected, semi-structured interviews were carried out with the purpose of determining the views of form teachers on Values Education.

As a result of the study, it was seen that the social values that were determined differed based on class levels, topics and the publishers of the textbooks. It was seen that the social values of Compassion, Respect, Responsibility, Helpfulness (collaboration), Tolerance, Benevolence, Universalism and Politeness were not distributed in a balanced was in the textbooks. Moreover, it was determined that social values were included to a relatively lesser extent in the 1st grade mathematics textbooks. Furthermore, the form teachers that were interviewed stated that they rarely encountered social value in mathematics textbooks.

Key words: Social Values, Primary School Mathematics, Textbooks, Teachers

REFERENCES

[1] Bishop, A. J. (1999). Mathematics teaching and values education-An intersection in need of research. *ZDM*, *31*(1), 1-4.

[2] Dede, Y. (2007). The place of values in mathematics teaching, *Abant İzzet Baysal University Journal of Faculty of Education*.

[3] Denscombe, M. (2010). *The good research guide: for small-scale social research projects*. 4th Edition, Open University Press.

[4] Gül, U. M. (2017). An investigation of values in Turkish textbook (5. th Grade) a valuable education approach. *Erciyes Journal of Education [EJE]*, *1*(1), 59-78.

[5] Küçükşen, K., & Budak, H. (2017). The Impact of High School Students' Social Value Preferences on Their Global Social Responsibility Levels. Journal of the Human and Social Sciences Researches, *6*(3), 1813-1826.

[6] Republic of Turkey Ministry of National Education (MEB) (2017). Values Education Directive. http://mebk12.meb.gov.tr/meb_iys_dosyalar/34/39/749197/dosyalar/2015_02/09093609_degerlere gitimi.pdf (02.04.2019).

[7] Topkaya, Y. (2016). The Opinions of Social Studies Teachers Regarding Value Transfer Approaches: A Qualitative Study. *Journal of Kirsehir Education Faculty*, *17*(1).

[8] Türk Dil Kurumu (2018). General Turkish dictionary. Web: http://www.tdk.gov.tr/index.php?option=com_gts&arama=gts&guid=TDK.GTS.5ca345026ffd52.72206141 (02.04.2019).

[9] Yaman, H., Taflan, S., & Çolak, S. (2009Values in Turkish textbooks in the second stage of primary education. Journal of Values Education, *7*(18), 107-120.

Studying strategies of undergraduate students

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ABSTRACT

Failure of students at the end of the instruction and education process is an increasingly significant problem. One of the most important reasons for students' failure is their lack of sufficient studying skills. For studying skills, it is important to use time correctly and study effectively (Bay, Tuğluk & Gençdoğan, 2005). For students to not waste their time, they need to know about the effective and productive ways of studying. Students should spend effort to learn and show the needed patience (Erdamar, 2010). Students need to know about themselves and determine the correct studying strategy (Subaşı, 2000).

This study aimed to determine the studying strategies of undergraduate students by using the qualitative research method of case study. In the case study method, the objective is to conduct an in-depth analysis of a case, situation, relationship or process with the help of a limited sample (Denscombe, 2010). The participants of the study consisted of 5 undergraduate students in their different years of study at the department of mathematics teaching. The data of the study were collected with the method of semi-structured interviews. The semi-structured interview form was prepared by the researchers. The data that were collected as a result of the interviews were analysed with the qualitative method of content analysis.

According to the results of the study, the prospective teachers were found to prefer the method of studying by writing the most. In addition to this, they were also observed to study by listening, reading and repetition before classes.

It was seen that the students were not able to use the studying strategies they aimed. It was determined that the students did not prepare before classes, and they did not use different methods during classes. The participants had tendencies of time and space for studying. They stated that they were more successful in courses for

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which they studied in quiet spaces. The participants were observed to use the same method for all classes.

Keywords: Studying strategy, effective studying, effective listening in classes

REFERENCES

[1] Bay, E., Tuğluk, M. N., & Gençdoğan, B. (2005). Examination of Prospective Examination of Prospective University Students' Study Skills, Electronic Journal Of Social Sciences, *4*(14), 94-105.

[2] Erdamar, G. (2010). Some Variables In Affecting The Study Strategies Of Student Teachers, H. U. Journal of Education, *38*(38), 82-93.

[3] Subaşı, G. (2000). The Effect of Productive Study Habits Training on Students' Academic Achievement, Academic Self-Concept and Study Habits, Education and Science, *25*(117).

[4] Denscombe, M. (2010). *The good research guide: for small-scale social research projects*. 4th Edition, Open University Press.

Investigation of the lesson plan development skills of mathematics teacher candidates within the scope of 4MAT model

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ABSTRACT

It is stated that teachers should have various competencies. The teacher competencies are expressed as “Knowledge, skills and attitudes that the teacher should have in order to perform his/her profession efficiently and effectively ((MoNE, 2017). One of these competencies is to effectively plan the education process (MoNE 2017). Lesson planning expresses the technical knowledge necessary to ensure effective classroom performance (Rusznyak and Walton 2011).

The 4MAT model developed by Bernice McCarthy is one of the models based on constructivism theory which can be used in lesson plan designs (McCarthy, 1990). The 4MAT model is an 8-step teaching cycle based on individual learning styles and brain hemispheres (McCarthy 1990). In the teaching process based on this model, students are active in the learning process and different strategies/methods/techniques are used (Morris and McCarthy 1999).

The aim of this research is to examine the mathematics teacher candidates' ability to develop a lesson plan for linear equation and slope subjects in the scope of the 4MAT model. The study group consisted of 16 teacher candidates who are studying at the 3rd grade of Elementary Mathematics Education. First of all, teacher candidates were asked to develop a lesson plan suitable for the learning outcomes in the subjects mentioned. Then, the 4MAT model was introduced and lesson plan examples based on the 4MAT model were presented. After the training, they were asked to redevelop their lesson plans by considering the 4MAT model. Each teacher candidate told the concepts based on these lesson plans. After the teachings, discussions and self/peer evaluations were made and they were asked to arrange the lesson plans by taking these discussions and evaluations into consideration.

The lesson plans developed by the teacher candidates were analyzed according to the lesson plan evaluation rubric developed by the researcher. Rubric included evaluation criteria based on both the 4MAT model and each of the pedagogical content knowledge components (content knowledge, knowledge of student understanding, knowledge of instructional strategies). Criteria in evaluations were determined as not observed (0 points), inadequate (1 point), partially sufficient (2 points) and sufficient (3 points).

It was analyzed by using appropriate tests (Friedman test, Wilcoxon test, One-way ANOVA for repeated measures) whether there was a statistically significant improvement in the PCK components in the lesson plans developed by the teacher candidates. In addition, simple linear correlation and regression analyses were conducted to examine the relationship between the 4MAT scores and PCK scores obtained from the last lesson plans. From the lesson plans, various sections showing the development of teacher candidates were presented.

As a result of the study, it was found that teacher candidates improved in terms of PCK components in each lesson plan development stage. In addition, it was seen that there was a positive and statistically significant relationship between the 4MAT scores and PCK scores obtained from the lesson plans they developed recently, and the scores predicted each other was at 74% level.

Key Words: Mathematics education, pedagogical content knowledge, lesson plans, 4MAT model, teacher candidates.

REFERENCES

[1] B. McCarthy, Using the 4MAT System to bring learning styles to schools, Educational Leadership. 48 (2) (1990) 31-37.

MoNE, General competencies of teaching profession, [Online]. [Accessed 11.06.2019]. Retrieved from http://oygm.meb.gov.tr/meb_iys_dosyalar/2017_12/11115355_YYRETMENLYK_MESLEYY_GENEL_YETERLYKLERY.pdf (2017)

[2] S. Morris, B. McCarthy, 4MAT in Action, Barrington, IL: Excel, Inc., 1999.

[3] L. Rusznyak, E. Walton, Lesson planning guidelines for student teachers: A scaffold for the development of pedagogical content knowledge, Education as Change. 15 (2) (2011) 271-285.

Mathematics teacher candidates' opinions based on developing lesson plan for geometry learning area: 4MAT model and whole brain model

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ABSTRACT

One of the models based on learning styles and brain hemispheres is the 4MAT model developed by Bernice McCarthy, and the other is the Whole Brain Model developed by Ned Hermann (Hermann 2000, McCarthy 1990). These models are similar in terms of arguing that learning styles can change and individuals can develop themselves in different learning styles. In addition, both models are based on the theory of brain hemispheres (Herrmann 2000, McCarthy 1990). However, when the models are examined, it is seen that besides these similarities, there are also features that differentiate these two models. While designing the teaching process based on the 4MAT model, an 8-step cycle is completed by sequencing the right and left hemisphere activities (McCarthy and McCCarthy 2003). In the design of the teaching process based on the whole brain model, instead of following a cycle, both the left and right hemisphere are addressed by trying to devote equal time to teaching methods for all learning styles (Herrmann-Nehdi 2008). In the transitions between quarters, no specific pattern such as right brain-left brain-right brain… is followed (Tezcan and Güvenç 2017).

It is thought that it is important to examine the effects of cyclic or noncyclical activation of the right and left brain on the learning process. In this context, the aim of this study is to examine the mathematics teacher candidates' ability to develop lesson plans based on the 4MAT model and the whole brain model and to get their opinions on the usability of the lesson plans developed according to these models.

The study group consisted of 16 teacher candidates who are at the 4th grade level of Elementary Mathematics Teaching Program. First of all, the 4MAT model and the whole brain model were introduced to teacher candidates. Examples of lesson

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plans developed based on these models were presented. Then, teacher candidates formed groups of four. Optionally, two groups developed lesson plans based on the 4MAT model and the other two groups based on the whole brain model. Teacher candidates were free to choose which learning outcome they want from the geometry learning area of the secondary school mathematics curriculum.

After developing the lesson plans, the teacher candidates presented these lesson plans in the classroom environment. In this process, individual notes were taken by other teacher candidates. The teaching of the concepts in the lesson plans was evaluated by using self and peer assessment forms. These forms were developed by the researcher and included the steps of the mentioned models. Teacher candidates revised their lesson plans by taking the evaluations into consideration and presented the revised lesson plan again. After the process was completed, teacher candidates' opinions were taken about developing lesson plans based on both models.

Teacher candidates found the 4MAT model more systematic than the whole brain model because it consisted of sequential steps. However, they stated that planning and implementation were more time-consuming. They also stated that they had more difficulty in designing activities based on the right hemisphere than the left hemisphere.

Key Words: Geometry, 4MAT model, whole brain model, lesson plan design.

REFERENCES

[1] N. Herrmann, The theory behind the HBDI and whole brain technology. [Online]. [Accessed 13.06.2019]. Retrieved from https://heikejordan.de/artikel/TheTheoryBehindHBDI.pdf, 2008.

[2] A. Herrmann-Nehdi, Whole brain design: engage and retain your learners, [Online]. [Accessed 13.06.2019]. Retrieved from https://www.elearningguild.com/showfile.cfm?id=2799 ,2008.

[3] B. McCarthy, Using the 4MAT System to bring learning styles to schools, Educational Leadership. 48 (2) (1990) 31–37.

[4] B. McCarthy, D. McCarthy, The 4MAT Implementation Workbook, Wauconda: About Teaching Companion., 2003.

[5] G. Tezcan, H. Güvenç, The effects of 4MAT teaching model and whole brain model on academic achievement in science, Education and Science. 42 (192) (2017) 1-23.

A meta synthesis study on mathematical literacy

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ABSTRACT

The ways of thinking that the world of our age expects from us in mathematics in general are in the form of being able to make interpretation, analyzing and make logical inferences. These forms of thinking are gathered under the concept of mathematical literacy. Recently, it has been observed that developed countries have focused too much on theoretical and experimental studies in the field of mathematical literacy. The aim of this study is to analyze by using meta-synthesis method the studies which were published between 2010-2019 indexed in the TUBITAK-ULAKBIM database and which included the terms " mathematical literacy, mathematics literacy, mathematics literateness " in the keywords. A total of 48 studies were examined and the results were gathered under certain themes through the stages of meta-synthesis research methodology. In the analysis of the data, categories were formed by making thematic codes. As a result of the analysis, the studies conducted in the field of mathematical literacy were collected under 9 categories namely; PISA data - literacy relationship, visual mathematics literacy, mathematics literacy - self efficacy beliefs, cross - country comparison of mathematics literacy, mathematics literacy self efficacy levels, mathematical literacy skill levels, mathematical literacy and affective characteristics and other categorical themes. As a result of the study, it was seen that most of the studies on mathematics literacy were made after 2016 and 38% of these studies were formed by using relational scanning method which is one of the non-experimental patterns of quantitative approach. This situation led to the limitation of articles in terms of method. The distribution of the researches by years and methods is presented in tables and graphs. In the studies examined, sample levels were shown in tables and it was observed that 35% of the sample group studied was on high school students.

As data collection tools, it was observed that the survey and achievement tests on 'PISA data' were the most studied among the tables. The data obtained from the study were analyzed using descriptive content analysis method. It is predicted that this study will bring a different and deep perspective to the people who will make research on mathematics literacy.

Key Words: Mathematical Literacy, Meta Synthesis, Content Analysis.

MSC: 97.

REFERENCES

[1] M. Altun, N. A. Gümüş, R. Akkaya, I. Bozkurt, T. K. Ülger, Investigation of Mathematics Literacy Skill Levels of Eighth Grade Students, Journal of Science, Mathematics, Entrepreneurship and Technology Education, 1(1) (2018) 66-88.

[2] G. Aksu, C. O. Güzeller, Classification of PISA 2012 Mathematical Literacy Scores Using Decision-Tree Method: Turkey Sampling, Education and Science 41(185) (2016) 101-122.

[3] E. Altıntaş, A. Ş. Özdemir, A. Kerpiç, Comparison of Perception of Preservice Teachers' Self Efficacy of Mathematical Literacy According to Their Program , Trakya University Journal of Education 2(2) (2012) 26-34.

An investigation of the misconceptions of seventh-grade students on ratio and proportion subjects

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ABSTRACT

Misconceptions are false beliefs and behaviors that are accepted by individuals as being true instead of the concept's definition (Yenilmez and Yaşar, 2008). The basis of misconceptions is wrong perceptions and comprehensions. Mathematical misconceptions are misconceptions that the student considers correct, not only with one case but systematically appearing in different situations, and which do not match the mathematical facts (Erbaş Çetinkaya and Ersoy, 2009). Akar (2014) examined the misconceptions about the ratio and proportions in three headings. These are student misconceptions about additive and multiplicative correlations, misconceptions about covariation and transformation, and misconceptions about invariance.

This study was carried out within the scope of “Conceptual Knowledge and Misconceptions” lesson which is the eighth-semester lesson of the Elementary Mathematics Teaching Program. The case study method was used in the study. The case study is a qualitative research model that is used to examine in depth the details of a situation where there are multiple data sources (Büyüköztürk et all 2012). The aim of this study is to investigate the misconceptions of 7th-grade students about the ratio and proportion subjects. For this purpose, a test consisting of 8 open-ended questions was developed by the researchers considering the learning outcomes in the 7th-grade ratio and proportions sub-learning area of secondary school mathematics curriculum. The test was examined by an expert and after the necessary arrangements were made it was applied to 35 7th grade students in two different secondary schools. The answers of the students who participated in the study were analyzed using the content analysis method. True-false frequency tables were given and examples of student responses were also presented.

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As a result of the study, students' misconceptions were collected in five categories. These categories include thinking the ratio as a real amount, not being able to grasp the proportion, not being able to establish a multiplicative relationship, not being able to establish the relationship between the two multiplicities, and confusing the direct proportion with the inverse proportion. In addition, misconceptions about algebraic expressions and fractions were determined in student responses. From this point of view, it is considered that comprehensive studies should be carried out both on the subject of ratio and proportion and the other mentioned subjects. It can be said that this study will lead to more comprehensive studies in the future with misconceptions about ratio and proportions.

Key Words: Mathematics education, misconception, ratio and proportion.

MSC: 97.

REFERENCES

[1] A.K. Erbaş, B. Çetinkaya, Y. Ersoy, Student Difficulties and Misconceptions in Solving Simple Linear Equations, Education and Science, 34(152), 2009.

[2] G. K. Akar, Difficulties and Solution Suggestions in Conceptual Learning of Ratio Subject. E. Bingölbali., & M. F. Özmantar (eds). Mathematical Difficulties and Solution Proposals in Primary Education, Pegem Academy, 2014.

[3] K. Yenilmez, E. Yaşa, Misconceptions of Elementary School Students in Geometry, Uludag University Faculty of Education Journal, 21(2), 2008, 461-483.

[4] Ş. Büyüköztürk, E. Kılıç Çakmak, Ö. E. Akgün, Ş. Karadeniz, F. Demirel, Scientific Research Methods (11th Edition), Pegem Academy, Ankara, 2012.

Analysis of errors and misconceptions about number theory through the notion of reducing abstraction

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ABSTRACT

Number theory as the 'queen of mathematics' with its history, formal and cognitive nature, has very important contributions to the development of mathematical concepts and problem solving (Campbell and Zazkis 2006). The aim of this research is to analyse the errors and misconceptions related to some concepts of number theory from the perspective of notion of *reducing abstraction.* The study group consists of 136 pre-service mathematics teachers from the departments of Primary and Secondary Mathematics Teacher of N.E.U A.K. Faculty of Education and the data are collected from the number theory questionnaire which is developed by the researchers. *Reducing abstraction* is a theoretical framework that examines students' tendency to work on a lower level of abstraction than the one which the concepts are introduced in class. From the perspective of reducing abstraction, learners find ways to cope with new concepts that they learn so they make these concepts mentally accessible and they would be able to think with them. This framework has been used for explaining students' conception in different areas of mathematics and computer science (Hazzan 1999, Hazzan 2003, Hazzan and Zaskis 2005). Although the term 'reducing abstraction' should not be understanded as a mental process which necessarily results in misconceptions or mathematical errors, in this research, we showed that this framework can also be used to analyse the students' errors and misconceptions.

Key Words: Misconception, number theory, reducing abstraction.

MSC: 97D70**,** 97F60, 97C30

REFERENCES

[1] Campbell, S.R., & Zazkis, R., Number theory in mathematics education: Perspectives and prospects. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers, 2006.

[2] Hazzan, O., Reducing abstraction level when learning abstract algebra concepts, Educational Studies in Mathematics, 40, 71–90, 1999.

[3] Hazzan, O., How students attempt to reduce abstraction in the learning of mathematics and in the learning of computer science, Computer Science Education, 13(2), 95-122, 2003.

[4] Hazzan, O. & Zaskis, R., Reducing abstraction: The case of school mathematics, Educational Studies in Mathematics, 58, 101–119, 2005.

Mathematical training needed for applying mathematics into electrical and electronics engineering

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ABSTRACT

In this paper, we present an approach for teaching mathematics to students with the goal of preparing them for a degree in electrical and electronics engineering. It is not surprising that electrical and electronics engineering is a field with mathematical applications, because of its connection to physics and the role mathematics in interpreting physical events. Basically, electrical and electronics engineering is the purposeful use of electromagnetic theory for building electrical systems that helps humanity (Agarwal and Lang 2005). That being said, many abstract mathematical theories are incorporated into the discipline (Guillemin, 1959).

The term “application of mathematics”, in the context of engineering, means real devices like cell phones. Indeed, electrical and electronics engineers use an applied mathematical theory for building communication systems (Shannon, 1948). In this context, our first aim is to stress the success of mathematics in electrical and electronics engineering with specific attention to relevant topics in mathematics.

In the second part, we discuss the mathematical studies needed for a successful professional engineering life. When applications of mathematics in electrical and electrical engineering is considered, developing mathematical skills for an undergraduate student is of vital importance (Uysal, 2012). Of course, the mathematics knowledge for academicians working in the field is beyond the level of undergraduate education, but the scope of this paper is undergraduate studies. Engineering courses in electrical and electronics engineering curriculums rely on mathematics (Tokuda et all 2017, Smith 1994). In mathematics courses taken by engineering, in particular electrical and electronics engineering students, we think both the basic concepts and some applications should be taught. In engineering courses, the best training for students is that both practical and theoretical aspects

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are covered in the class (Özgüler, 2003). We discuss the curriculum of our department and the relation of engineering courses to some mathematics courses. Circuits and electronics courses require complex algebra, calculus, linear algebra and differential equations. The fundamental mathematics requirement for communications is probability and statistics. Not only the mathematics courses in initial years but also the mathematical skills developed in engineering courses helps student learn the theory of engineering. For example, in electromagnetic theory, vector calculus is taught in the beginning of the course. Signals and systems and control systems courses teach difference equations and mathematical transformations. We believe that is the mathematics training needed for the stated goal. Furthermore, survey results on engineering students taking mathematics courses are presented and discussed with regard to our approach.

Key Words: Mathematics education, engineering education, improving the curriculum, information and communication, circuits.
MSC: 94, 97.

REFERENCES

[1] A. Agarwal, J. H. Lang, Foundations of Analog and Digital Electronic Circuits, Morgan Kaufmann, 3-4, 2005.

[2] E. A. Guillemin, The role of applied mathematics in the electrical engineering art, Electrical Engineering, 78 (5) (1959) 414–461.

[3] C. E. Shannon, A mathematical theory of communication, The Bell System Technical Journal, 27 (3) (1948) 379–423.

[4] F. Uysal, The Mathematics Education for the Engineering Students of 21st Century, TOJNED: The Online Journal Of New Horizons In Education, 2 (2) (2012) 65–72.

[5] M. Tokuda, A. Fujimoto, T. Mori, T. Sakuma, Teaching mathematics to electrical engineering students by electrical engineering staff in college of technology in Japan, IEEE International Conference on Teaching, Assessment and Learning for Engineering, Bali, 2017.

[6] H. W. Smith, University of Toronto curricula in electrical and computer engineering, IEEE Transcations on Education, 37 (2) (1994) 158-162.

[7] A. B. Özgüler, Innovations in Bilkent University Electrical and Electronics Engineering Curriculum and ResultsElectrical, Electronics, Computer Engineering Education 1st National Symposium, Ankara, 2003 (in Turkish).

Views of prospective elementary teachers' about use of concrete materials in mathematics teaching

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ABSTRACT

The importance of using concrete materials is emphasized in the middle school mathematics curriculum which is applied in our country and based on student-centered approach. The new mathematics curriculum is based on the ability of students to explore and make sense of mathematical knowledge through concrete models. In order to use concrete materials effectively in mathematics teaching, teachers should have sufficient knowledge (Çiftçi, Yıldız and Bozkurt, 2015; Pişkin-Tunç, Durmuş and Akkaya, 2012; Yetkin-Özdemir, 2008; Yazlık, 2018). In this respect, the aim of this study is to examine the prospective mathematics teachers' views about use of concrete materials in mathematics teaching.

In the research, case study that is based on qualitative approach has been used. The study was conducted in a state university's elementary mathematics teaching program with 39 prospective teachers who took instructional technologies and material design courses. 85% of the participants are girls. The data of the study was collected after the completion of the course at the end of the semester. Prospective teachers designed a concrete material in the form of groups of 3-4 people. The research data were collected through the interview form after this experience of the prospective teachers. In the interview form, the participants were asked four open-ended questions (eg. How concrete materials help to understand the ideas of a mathematics concept?). The participants were asked to answer these questions in writing. The data obtained from the interview form were analyzed using content analysis method. In this process, the coded data were arranged and interpreted under certain themes.

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The findings of the study showed that primary mathematics teachers think that the use of concrete materials in teaching mathematics is important and effective. This finding is in line with the findings of other studies (Çiftçi, Yıldız and Bozkurt; Yetkin-Özdemir, 2008; Yazlık, 2018). Yetkin-Özdemir (2008) concluded that prospective elementary teachers believed that the use of materials was effective in mathematics education.

Another result of the research was that participants think that the use of concrete materials in mathematics classes made it easier to understand mathematical concepts, concretized abstract concepts, provided permanent learning and aroused curiosity among students. On the other hand, it was seen that pre-service teachers' ideas about how the use of concrete materials help to understand and concretize the concepts of mathematics are general and superficial. In parallel with these results, it is concluded that using concrete material provides similar benefits in the literature (Çiftçi, Yıldız and Bozkurt; Ünlü, 2017; Yetkin-Özdemir, 2008; Yazlık, 2018).

These findings indicate that prospective teachers need more experience in the use of concrete materials in mathematics teaching. They need to acquire knowledge to explore the relationship between material and mathematical concept. It is important for prospective teachers to establish the relationship between material and concept in order to provide meaningful learning.

Key Words: Mathematics education, concrete materials, prospective teachers.

REFERENCES

[1] Çiftçi, K., Yildiz, P., and Bozkurt, E. (2015). Middle School Mathematics Teachers' Opinions About Using Material, Journal of Educational Policy Analysis *4 (1)*, 79-89.

[2] Özdemir, İ. E. Y. (2008). Prospective Elementary Teachers' Cognitive Skills On Using Manipulatives In Teaching Mathematics, Hacettepe University Journal of Education, *35*(35), 362-373.

[3] Pişkin-Tunç, M., Durmuş, S., ve Akkaya, R. (2012). Competence of elementary mathematics teacher candidates to use concrete materials and virtual learning objects in mathematics teaching. MATDER Mathematics Education Journal, *1*(1), 13-20.

[4] Ünlü, M. (2017). Opinions of Pre-service Mathematics Teachers on the Use of Teaching Material in Mathematics Courses. *Theory and Practice in Education, 13*(1), 10-34.

[5] Yazlık, D. Ö. (2018). The Views of Teachers About Use of Concrete Teaching Materials in Mathematics Teaching. OPUS International Journal of Society Researches, *8*(15), 775-805.

Investigation of the operational knowledge levels of the 7th grade students' about central tendency

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ABSTRACT

Skills related to the field of statistics are being polled both nationally and internationally, as well as the importance of interpreting the data related to this field in daily life. It is also observed in the curriculum that most of the basic skills related to the field of statistics, which are used for different purposes in many areas ranging from the management of consumer perceptions to the educational measurement and evaluation in daily life, are also aimed to be given to the students at secondary school. Calculation of range, median, mean and mode are the basic skills for data learning area in the mathematics curriculum. In the literature, it is known that students tend to memorize the statistical rules, they deal with operational information, and they experience difficulties in conceptual learning (Ben-Zvi, 2000). In this situation, it can be thought that teachers avoiding explaining the concepts related to statistics (Malone and Miller, 1993) by considering that students may have difficulty in understanding the statistical terminology. In this study, the level of operational knowledge of 7th grade students in terms of these concepts was examined. The study was in descriptive survey model and the study group was formed by appropriate sampling method. The study group consisted of 74 7th grade students. In the research, a data collection tool consisting of three questions which require explanation and calculations related to mode, median, mean and range were used. The data of the study were processed and analyzed in Microsoft Excel. According to the findings of the study, it is seen that the definition of the 7th grade students about the related concepts mostly related to the algorithms used in the calculation of these measures, so that the students made explanations without the conceptual understanding of the related measurements. The errors made by the students are as

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follows: When calculating the median, the data are taken into consideration in the middle without sorting the data, determining the mode as the smallest or largest number in the group, selecting one of the two data in the middle as the median. These errors may be caused by the students' mixing of the processing process they have for these measures and the fact that they experienced a teaching process in which conceptual and operational information was not employed at the same time. In the future studies, detailed information about error sources can be obtained by conducting one-to-one interviews with students who exhibit certain error patterns. In the teaching process, instead of the exercises that are detached from the context, it can be suggested that the contexts in which the students produce the data or use the actual data as suggested in the literature should be employed. In this way, students will be able to make more accurate interpretations for the data groups that require interpretation of these measures and to obtain conceptual and operational knowledge.

Keywords: Operational knowledge, measures of central tendency, data processing
MSC : 97

REFERENCES

[1] Ben-Zvi, Dani. (2000). Toward Understanding the Role of Technological Tools in Statistical Learning. Mathematical Thinking and Learning. 2. 127-155. 10.1207/S15327833MTL0202_6.

[2] Malone, J. and D. Miller (1993), Communicating mathematical terms in writing: Some influential variables. In: M. Stephens, A. Waywood, D. Clark and J. Izard (eds.), Communicating Mathematics: Perspectives from Classroom Practice and Current Research (pp. 177-190). Australian Council for Educational Research.

Metaphoric perceptions of middle school students about the concept of zero

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ABSTRACT

Mathematics is regarded as an abstract and difficult course to understand by students. For this course, which is considered so by most students, it is important to learn the thoughts which they create in their minds. Therefore, metaphors are a good tool for this.

The word "metaphor", which was derived from the Greek word "Metapherein", was formed by combining the word "meta", which means "change", and "pherein", which means "carry" (Levine, 2005). Metaphor studies started in the 2000s for the first time in our country and it was aimed to reveal the thoughts of individuals on facts or concepts about educational sciences (Şeyihoğlu ve Gencer, 2011).

Metaphors are thought to be one of the figures of speech we use only in everyday life and to make the language fancy but its place in human life is much more than that (Saban, 2004). For example; when defining or explaining a concept, the result is achieved by simulating the described concept to a known concept. Also, metaphor studies are covered in many areas of education (Döş, 2010).

When the literature was examined, it was observed that the studies related to metaphors were made to learn the participants' metaphoric perceptions about general concepts such as “Mathematics, Mathematics lesson, Mathematics teacher”. In this study, it was aimed to reveal the perceptions of middle school students towards the concept of zero which is very significant in mathematics.

This study was conducted with 112 middle school students attending a public school in the central district of Gaziantep in the fall semester of the 2018-2019 academic year. For data collection, the students were asked to complete the sentence "Zero is like ... because ...". In this way, the metaphors of the students about the concept of zero were determined and categorized using the content analysis method in the analysis of the collected metaphors. According to the results, "neutral element, absorbing element, nothing, non-value number, beginning of life and end of life metaphors" are the most frequently used ones for the concept of zero. When the metaphors for the concept of zero were categorized as a result of the study, "mathematical concepts, life, and living being" categories stood out. Also, suggestions were made for mathematics teachers in the direction of the results collected and it was thought that it would contribute to the literature because of the lack of metaphor studies on the concept of zero.

Key Words: Metaphor, zero, middle school students

MSC: 97.

REFERENCES

[1] *İ. Döş, Metaphoric Perceptions of Candidate Teachers To The Concept of Inspectors, Gaziantep University Journal Of Sport Science, 9 (3) (2010) 607-629*

[2] *P. M. Levine, Metaphors and Images of Classrooms, Kappa Delta Pi Record, İndianapolis. 41 (4) (2005)*

[3] *A. Saban, Entry Level Prospectıve Classroom Teachers' Metaphors About The Concept Of "Teacher" , The Journal of Turkish Educational Sciences, 2 (2) (2004) 131-155.*

[4] *A. Şeyihoğlu, G. Gencer, Use of "Metaphor" technique in life science teaching, Journal of* Turkısh Scıence Educatıon 8 (3) (2011) 83-100

Mathematics learning conceptions of 8th grade students

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ABSTRACT

Literature reports that students' learning conception is associated with their learning (McLean, 2001; Peterson, Gavin, Irving, 2010). However, there is still much work to do to further clarify how students think about mathematics learning. In the literature there is a lack of understanding about how middle school students experience and perceive mathematics learning. To fill this literature gap, this present study intended to investigate how middle school students' mathematics learning experiences vary, and how they conceptualize mathematics learning. Understanding students' conceptions about mathematics learning may lead educators to provide better learning opportunities for the students in mathematics lessons.

This present study was conducted with respect to a qualitative phenomenological approach. This approach describes how human beings commonly experience a certain phenomenon. In this study the phenomenon investigated is the students' mathematics learning experience. More specifically, our purpose in this study is to understand the essence of students' mathematics learning by focusing on their descriptions about their own learning experiences (Creswell, 2013; Merriam, 2018).

In the spring of 2019, semi-structured qualitative interviews were conducted with seven 8th grade students in a public school in Turkey. Participant students were purposively sampled so that the sample included students from high, middle and low mathematics achievement level. The interviews were lasted 20-25 minutes, recorded and transcribed. Questions asked to the participant students were of several types related to their knowledge, experience, behaviors, opinions, values and feelings about learning mathematics. MAXQDA software was used in the analyses (VERBI Software 2017). Each interview was read and students' statements were coded with

a descriptive label. Statements that did not contribute our understanding of students' mathematics learning were reduced and eliminated. The remaining invariant labels were then clustered with respect to similarities among them and each cluster was coded with a suitable theme. This step was repeated until all invariant labels were clustered into a theme.

Seven core themes emerged in the analyses are: (1) reproducing and remembering, (2) requiring a prior knowledge and experience, (3) increasing knowledge by the help and support of others, (4) understanding by focusing, (5) reasoning when solving problems, (6) being a part of life and (7) having a positive attitude and self-confidence. Having a positive attitude and self-confidence, and reproducing and remembering were the themes students mostly associated with their mathematics learning. Students modestly associated their learning with understanding by focusing. The least associated theme was the reasoning when solving problems. On the other hand, it is clear that students do not favor of the current curriculum reforms prioritizing reasoning in problem solving.

Key Words: Mathematics learning, middle school students, conceptions, phenomenology

MSC: 97

REFERENCES

[1] M. McLean, Can we relate conceptions of learning to student academic achievement?, Teaching in Higher Education, 6:3 (2001), 399-413.

[2] E.R. Peterson, G.T.L. Brown, S. E. Irving, Secondary school students' conceptions of learning and their relationship to achievement, Learning and Individual Differences, 20 (2013), 167-176.

[3] J.W Creswell, Qualitative Inquiry and Research Design: Choosing Among Five Approaches. Tousand Oaks, CA: Sage Publications, 2013.

[4] S.B. Merriam, Qualitative research. A guide to design and implementation. San Fransisco, CA: Jossey-Bass, 2018.

[5] VERBI Software, MAXQDA 2018 Online Manual, 2017. Retrieved from https://www.maxqda.com/help-max18/welcome

Assessment of early mathematics skills in preschool

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ABSTRACT

The study aims to evaluate the mathematical skills of 60-72 months children in kindergartens in Ankara and to propose a framework as a result of this. For this purpose, 300 children (152 female, 148 male) from different socioeconomic levels within separate kindergartens or primary schools under the Ministry of National Education were included in the study.

Mathematical skills of the children were evaluated by Mathematical Thinking Skills Assessment Tool (MATBED) developed for kindergarten children, consisting of five subtests (Digit Recognition, Addition-Subtraction, Grouping, Pattern, and Geometry), which was conducted validity and reliability studies. To evaluate the mathematical performance of children, the interviews were carried out individually with each child in a quiet and calm environment out-of-the classroom. Each interview of the test lasted approximately 25-30 minutes.

Data were transferred to SPSS and analyzed in two parts. Firstly, descriptive statistics of the data obtained from MATBED were given and distribution of the data according to each subtest was examined. Then, the mean scores obtained from each subtest of MATBED were supplied with the tables. In the second part, it was investigated whether early mathematics skills differentiated according to socioeconomic level among children. Finally, in the discussion part, the data related to each subtest were compared with the cut-off scores of MATBED, and dual comparisons at lower and upper socioeconomic levels were discussed.

Key Words: Mathematics, kindergarten children, addition-subtraction, geometry, grouping, pattern.

REFERENCES

[1] Akman, B. (2002). Mathematics in preschool. Hacettepe University Faculty of Education Journal: 23, 244-248.

[2] Baker, S., Gersten, R., & Lee, D. (2002). A Synthesis of Empirical Research on Teaching Mathematics to Low-Achieving Students. The Elementary School Journal, 103, 51-73.

[3] Edward, M. L., Gallimore, R., Garnier, H., & Reese, L. (2007). Preschool antecedents of mathematics achievement of latinos: The influence of family resources, early literacy experiences and preschool attendance. Hispanic Journal of Behavioral Sciences, 29(4), 456-471.

[4] Ergül, A. (2014). Developing Early Mathematical Reasoning Skills Assessment Tool. Published PhD Thesis. Hacettepe University, Ankara.

[5] Gersten, R., Jordan, N.C., & Flojo, J.R. (2005). Early Identification and Intervention for Students withMathematics Difficulties. Journal of Learning Disabilities, 38(4), 294-304.

[6] Kandır, A., & Tümer, N.B. (2013). Investigation of Early Learning Skills of Children of Five to Six Years of Age at Different Socio-economic Levels. Social Policy Studies: 7 (30), 45-60.

Classroom design of prospective middle school mathematics teachers

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ABSTRACT

There are many factors that affect teaching and learning. One of these factors is design of classroom environment. Environmental modifications are affective methods supporting classroom management and a well-designed classroom supports positive relationship between the teacher and students (Guardino and Fullerton, 2010). In addition, classroom setting can help to increase academic engagement and to decrease disruptive behaviours (Phillips, 2001; Guardino and Fullerton, 2010; Guardino and Antia, 2012; Rimm-Kaufman, Paro, Downer and Pianta, 2005). Philips (2001) conducted case studies with four elementary schools, which have changed design of their school and results of all four studies showed that constructing a positive learning environment and increasing academic achievement are possible with good interior design. In this respect, the purpose of this study is to investigate ideal mathematics classroom environment in prospective middle school mathematics teachers' minds and to compare elements of classroom environment according to grade level.

Drawings, as a qualitative method, was used for this study. The participants of this study were 262 prospective middle school mathematics teachers in elementary mathematics teacher education program at Erciyes University. The sample groups includes 69 first grade, 66 second grade, 72 third grade and 55 fourth grade prospective teachers. The data was collected at the end of spring semester. Participants were given a blank paper and asked to draw ideal mathematics classroom that they imagine. Prospective middle school mathematics teachers focused on seating arrangement and location of blackboard. The most preferred seating arrangements are semicircle (horseshoe), double horseshoe, row-and-

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column (traditional), roundtable, and clusters. Although some of prospective teachers chose different seating arrangement, they added extra roundtable or clusters for group works. Some students' drawings includes computers in addition to desks and they explained that students could use computers if they need. A few prospective teachers design distance education classroom, online education classroom and computer-based classroom. Most of third and fourth grade prospective teachers emphasized on having concrete materials in the classroom, but the vast variety of first and second graders did not mention materials.

Key Words: Mathematics education, prospective teacher, classroom design.

MSC: 97

REFERENCES

[1] C. A. Guardino, E. Fullerton, (2010). Changing Behaviours by Changing the Classroom Environment. Teaching Exceptional Children, *42*(6) (2010) 8-13.

[2] S.J. Philips. The Ideal Learning Environment: Case Studies of Design Solutions for Schools. The Impact of Classroom Design, ERIC, ED473986, 2001.

[3] C. Guardino, S. D. Antia, Modifying The Classroom Environment to Increase Engagement and Decrease Disruption with Students Who Are Deaf or Hard of Hearing, Journal of Deaf Studies and Deaf Education, *17*(4) (2012) 518-533.

[4] S. E. Rimm-Kaufman, K. M. La Paro, J. T. Downer, R. C. Pianta, The Contribution of Classroom Setting and Quality of Instruction to Children's Behaviour in Kindergarten Classrooms. The Elementary School Journal, *105*(4) (2005) 377-394.

Teaching of algebraic expressions with creative drama method

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ABSTRACT

The most important aim of teaching mathematics is to provide the individuals to reach a solution in the shortest way when they encounter a problem in life (Baykul, 1997). The creative drama method carries the daily life problems to school subjects. The creative drama method that makes the students active, provides an area away from stress, develops creativity is one of the most effective methods in mathematics teaching. The studies done about the usage of the creative drama in mathematics education in Turkey are found after the year 2000.

The aim of this research is to analyze the effect of using creative drama method in teaching the subject of “Algebraic Expressions” at 6th grade of secondary school level on the students’ success, permanence of their information and their anxiety and attitude towards maths.

The quantitative part of this study is a semi-experimental research with pre-test-post-test control group. At the beginning of the study, two classes of 6th grade, which there was not significant difference between in terms of success, were identified by analyzing the results of pre-test. This study was carried out with 34 students in total, that were 17 students for each two classes assigned as experimental group and control group randomly. In the fall semester of the 2018-2019 academic year, two 6th grade classes in one of the villages of Karatay district of province of Konya were participated in the research.

Three educational attainments in the subject of “Algebraic Expressions” were taught in accordance with the curriculum of the creative drama prepared by the researchers in experimental group, and the traditional method in control group. Algebraic Success Test prepared by the researchers, Attitude Scale prepared by Önal (2013) and Anxiety Scale prepared by Bindak (2005) were implemented as the pre-test on the two groups. The implementation lasted for about 2 weeks during 10

lessons time. After the implementation, Algebraic Success test, Attitude and Anxiety Scales were implemented on two groups again. Algebraic Success Test were implemented again 6 weeks later as permanence test.

For the qualitative part of the research, experimental group students were requested to write a letter about the study after the implementation. All emotions and thoughts that were dominant in the students were denoted on a chart by analyzing the letters.

According to the results of this study, it has been pointed out that teaching the subject of algebraic expressions at 6th grade with the creative drama method increased the students' success and made all the information permanent. The result has been reached that teaching of algebraic expressions could not make any serious difference on attitude and anxiety levels of the students towards maths with this method. According to the thoughts of experimental group students, it has been concluded that teaching algebraic expressions with creative drama method was entertaining, the importance of unity and solidarity was understood better, the lesson was understood better and students wanted the teacher to teach the lesson by using this method.

Key Words: Algebraic expressions, creative drama, 6th grade students

MSC: 97.

REFERENCES

[1] Y. Baykul, Teaching Mathematics in Primary Education, Elit Publishing, Ankara, 1997.

[2] R. Bindak, Math Anxiety Scale For Elementary School Students, Fırat University Journal of Engineering Sciences17(2), 442-448, 2005.

[3] N. Önal, Scale development study for mathematics attitudes of secondary school students, Elementary-Online, 12(4), 938-948, 2013.

Mathematics teachers' views on scenario based learning method

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ABSTRACT

The rapid changes in science and technology, the changing needs of the individual and society, the innovations and developments in learning and teaching approaches have also influenced the roles expected from teachers and students. This change refers to individuals who produce information, use it in life, solve problems, think critically, and have communication skills (MEB, 2018). Therefore, it is an indisputable fact that the scenario based learning method, which is effective in activating students and associating information with real life, is important in achieving this aim for students. Scenario based learning is a learning method in which goals and behaviors that should gained to individuals are formed within the framework of scenarios. Individuals try to reach the aim by putting themselves in place of the actor in the story and producing solutions to problems (Veznedaroğlu, 2005). With this method, real life events are integrated into the classroom environment and presented to the students. Thus, individuals experience how to behave in the face of a problem. In addition, individuals who learn with the help of scenarios, actively use different high level thinking processes such as analysis, synthesis, evaluation and decision making skills (Açıkgöz, 2007). Although it has made significant contributions to the teaching process, the questions of how long and in which way this method is used in mathematics lessons led us to do this study. Determining what teachers think about scenario based learning method is also one of the reasons of research. Accordingly, the aim of this study was to determine the views of mathematics teachers about the use of scenario based learning method in mathematics lessons. The data of the study was collected from mathematics teachers by using open ended questions prepared by the researcher in the spring semester of 2018-2019 education. Descriptive analysis method was used to analyse the data obtained in the study. The

answers received from teachers by this method were examined and classified. The results reached were interpreted and suggestions were made.

Key Words: Scenario based learning, teacher views, mathematics teaching.

MSC: 97.

REFERENCES

[1] K. Açıkgöz, Active Learning, Biliş Publishing, İzmir, 2007.

[2] MEB, Secondary Mathematics Course (9,10,11 and 12th grades) Teaching Programı, Republic of Turkey Ministry of National Education, 2018.

[3] M. Veznedaroğlu, The effects of scenario based learning on attitudes and self efficacy beliefs of teacher candidates' towards teacher proficiency, Master Thesis, Ankara University, Ankara, 2005.

Content analysis of problem posing studies published in the field of mathematics education in Turkey

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ABSTRACT

With the result of deep changes in the educational programs seen in Turkey since 2005, constructive educational programs have begun to be applied. Among various reforms brought by this educational program, basic skills have been given importance. In Turkey, the goal of mathematics education at all levels is improving students' problem-solving strategies and fostering the use of these strategies in problem solving [1]. The idea of problem-solving competence, based on the improvement of problem-solving skills, is associated with Polya's four-step problem-solving process plus the problem-posing step added by Gonzales. Researchers in mathematics education view problem posing as a significant mental activity in mathematics (e.g. [2]). In fact, some researchers referred to it as being at the heart of mathematics [3]. Problem posing is a research topic in mathematics that is currently receiving the attention of many mathematics educators (e.g. [4]). Therefore, many researches have been done about problem posing since 2005 in Turkey. Thus, comprehensive analysis is needed to see exactly how these studies have been handled. It is thought that if studies on the same topic are organized under certain themes and critiqued in the same manner, it can contribute to the instruction of social sciences. In this frame, the purpose of this study was to determine the tendency of problem posing studies published between the years 2005 and 2019 in the field of mathematics education in Turkey and guiding future researchers who are planning to carry out studies in the related topic.

With this purpose, qualitative research methods and techniques were used in this study. This study was conducted using the content analysis model. Studies were analyzed according to: year of publication, type, subject, learning area, research design, method, data collection instruments, data analysis method, sample type, sampling method, number of participants categories, and data analysis methods. A

According to the findings of the research, especially after the year 2011, it has been determined that the studies for problem posing in Turkey continue increasingly. When the distribution of thesis-article related to problem posing studies is examined, it is found that the number of articles published in this field is higher than the thesis studies. Besides, theses for problem posing have been concentrated at the graduate level. It was seen that the studies focused on examining the problem-posing skills of students or teacher / prospective teachers. In addition, studies have been conducted on the effect of teaching with problem posing approaches on learning outcomes, the place of problem posing in the textbooks/ mathematics curriculum and developing scale related to problem posing skills. It has been determined that the studies are generally oriented towards the field of learning numbers and operations. Most of the studies were conducted with the participation of middle school students or prospective mathematics teachers. The results of this study is believed to be a guide for new research. It is thought that the results can be useful for seeing the strengths and weaknesses of the studies carried out on the field.

Key Words: Problem posing, mathematics education, content analysis.

MSC : 97.

REFERENCES

[1] Ministry of National Education, Mathematics Curriculum (Primary and Middle School 1, 2, 3, 4, 5, 6, 7 and 8th Grades), Ministry of National Education, Board of Education, 2018. http://ttkb.MoNE.gov.tr. Accessed 7 May 2018.

[2] S. Silber, J. Cai, Pre-Service Teachers' Free and Structured Mathematical Problem Posing. International Journal of Mathematical Education in Science and Technology, 48(2), 163-184, 2017.

[3] K. Kojima, K. Miwa, T. Matsui, Experimental Study of Learning Support through Examples in Mathematical Problem Posing. Research and Practice in Techology Enhanced Learning., 10(1), 2–18, 2015.

[4] Y. Katrancı, S. Şengül, The Relationship between Middle School Students' Attitudes Towards Mathematical Problem-Posing, Attitudes Towards Mathematical Problem-Solving, and Attitudes Towards Mathematics. Education and Science, 44 (197), 1-24, 2019.

Number sense test development for primary school 1st grade students: validity and reliability study

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ABSTRACT

In mathematics education, it is mentioned that number sense should be gained in advanced class levels since early childhood (CCSS, 2010; NCTM, 2000). Primary education students who fail to gain sense of numbers it is stated that they carry a great risk of failure in mathematics (Witzel, Riccomini & Herlong, 2013). Therefore, it is important to gain the sense of number starting from an early age and to determine the sense of number skills for this purpose.

This study was conducted in order to develop a valid and reliable test on Number Sense. While developing the Number Sense Test, the gains in the first grade mathematics program and the number sense components (instantaneous counting, relative size of the number, perceptual estimation, contextual estimation and mind calculation) identified in the literature (Olkun, 2012) were used. Thus, a 21-item test was prepared. For the validity of the items of the test, two experts in the field of mathematics education and one linguist's opinion were used for their suitability for grammar. The test was piloted with 81 first grade students in a public school. In the direction of the students' answers to the items in the test, item analysis was performed and the discrimination and difficulty indices of each item were calculated separately.

As a result of item analysis, 3 items were excluded from the test and the Number Sense Test consisting of 18 items was created. The mean difficulty of the test was 0.68 and the mean discrimination was 0.48. According to the data obtained from item analysis, KR 20 reliability coefficient was calculated as 0.75. It is thought that the test developed for 1st grade students, which is a critical period in the development of number sense, will contribute to the literature and can be used as a tool in the studies that are formed within the framework of different methods.

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Key Words: 1st grade, test development, number sense.

MSC: 97.

REFERENCES

[1] Common Core State Standards Initiative (2010). Common Core State Standards for Mathematics. Council of Chief State School Officers and National Governer's Association website: http://www.corestandards.org/wp-content/uploads/Math_Standards.pdf

[2] National Council of Teachers of Mathematics (NCTM), (2000). Principles and standards for school mathematics. Reston, VA: National Council of Teachers of Mathematics.

[3] Olkun,S.(2012). https://www.researchgate.net/publication/283711235_Sayi_hissi_Nedir_Neden_onemlidir_Nasil_gelisir_2012_Egitimci_10_6-9.

[4] Witzel, B. S., Riccomini, P. J., & Herlong, M. L. (2013). Building number sense through the common core. Thousand Oaks, CA: Corwin Press

A research on mathematics education post-graduate thesis' compatibility to paradigm shift in reliability

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ABSTRACT

The study named *A research on mathematic education post-graduate thesis' compatibility to paradigm shift in reliability* is about the reliability in theses, the usage of reliability term and the contemporary paradigm of reliability. In this research, post-graduate and doctoral theses' compatibility of paradigm shift in reliance was analyzed and mistakes were detected in the field of mathematics education. It is aimed to avoid repeating the same mistakes in scientific studies to be prepared.

For this purpose, between the years 2000-2016, a total of 113 theses including 11 doctoral and 102 postgraduate were examined at Gazi University, in the field of Mathematics Education. In this study, which reviews of postgraduate and doctoral theses are done with the screening model, the data was summarized in frequency and percentage.

Theses' compability to contemporary paradigm of reliability was evaluated, based on various perspectives such as differences in the use of term reliability, reliability induction, reliability estimation methods of score, score reliability coefficients, sample size used in reliablity studies, confidence interval of score reliability coefficients and effect size. According to the results obtained from the research, 19% of examined theses in other words in almost 1 of 5 theses did not have reliability studies; in 38% of theses, the reliability induction was done; Paradigmatic misconceptions exist in 74%, almost 3 of 4 theses; in 43% the reliability coefficient reported as lower than 0.80; Confidence interval of reliability coefficients were not reported in 100%; The sample size at 100% is less than 400; The effect size was not reported in 100%. It is also found that Kuder-Richardson and Cronbach alfa are the most widely used reliability estimation methods. These findings were discussed and possible solutions and suggestions were propounded.

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Key Words: Reliability, score reliability, reliability induction, reliability estimation methods, errors in use of reliability, paradigm shift.

MSC: 97.

REFERENCES

[1] AERA, APA ve NCME [American Educational Research Association, American Psychological Association ve National Council on Measurement in Education], Standards For Educational And Psychological Testing, American Educational Research Association, Washington, DC, 1999.

[2] AERA, APA ve NCME [American Educational Research Association, American Psychological Association ve National Council on Measurement in Education], Standards For Educational And Psychological Testing, American Educational Research Association, Washington, DC, 2014.

[3] Bademci, Vahit, It Is Incorrect To Speak Of "The Reliability Of The Test " Or "The Test Is Reliable", The Journal of Turkish Educational Sciences , 2(3), (2004) 367-372.

[4] Bademci, Vahit, Paradigm Shift in Measurement and Research Methodology: Tests are Unreliable, Yenyap Publishing, Ankara, 2007a.

[5] Sireci, Stephen G., On Validity Theory and Test Validation, Educational Research, Cilt 36, Sayı 8, (2007) 477-481.

Knowledge of slope concept in mathematics textbooks in undergraduate education

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ABSTRACT

This work questions the prevailing approach in the presentation of the concept of slope in undergraduate teaching in Turkey. For this purpose, it analyzes five mathematics textbooks taught in undergraduate education, two of which are translated and three of which are not translated, in terms of similarities and differences of solved problems. In the study, the subjects related to the slope in the textbooks were categorized and examined within the context in which they were handled. Therefore, this study is a qualitative study that adopts the interpretive paradigm. These categories are discussed in the form of connectivity, exploration and purpose using the study for the context (Rezat, 2006). For cognitive development categories are discussed in the form of geometric ratio, behavior indicator, feature determinant, algebraic ratio, parametric coefficient, functional trait, linear constant, real life, physical trait, trigonometric concept, calculus (Stump, 1999; 2001b). For visual representations, Wileman's work /1993) was used as pictorial representations; image and concept. Representations of process skills are discussed in the form of algebraic expression, tables and graphs. In the use of technology categories are discussed in the form of BCS, DDY, Scientific Calculators, Graphic Calculators, Internet (Akkoyunlu, 2002; Schware & Jaramillo, 1998). Performance categories are discussed in the form of definition, justification, explanation. Compared to translate the book, Turkey's textbooks 1 contains more algebraic expressions, the use of the grounds and explanations and real-life connection, 2 contains applications that use more formulas, 3. Description is to use less highlighted is 4 technology, 5. other math they do not explicitly state their links with the subject areas. In general, it was seen that translated textbooks were mostly related to real life, equipped with explanations and justifications requiring cognitive competencies, and proceeded harmoniously

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between the subject area main ideas and related ideas. These books use multi-step solved problems. Turkish textbooks should be reviewed in terms of scope, cognitive requirement, representations, technology and performance.

Key Words: Slope concept, undergraduate mathematics textbooks.

MSC: 97

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REFERENCES

[1] Rezat, S. (2006). A model of textbook use. Proceedings 30th Conference of the International Group for the Psychology of Mathematics Education, 4, 409–416. Prague: PME.

[2] Stump, S. (1999) Secondary mathematics teachers' knowledge of slope. Mathematics Education Research Journal, 11(2), 124–144.

[3] Stump, S. (2001b). High school precalculus students' understanding of slope as measure. School Science and Mathematics, 101, 81–89

[4] Akkoyunlu, B. (2002). Educational technology in Turkey: Past, present and future. Educational Media International, 39, 165-174.

[5] Schware, R., Jaramillo, A., (1998) Technology in education: The Turkish experiment , Information Technology for Development, 8:1, 29-33

[6] Wileman, R. E. (1993). Iruual Communicating. Educational Technology Publications: Englewood Cliffs. New Jersey. USA.

Investigation of the concept definitions of teacher candidates: Sample of rhombus and parallelogram

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ABSTRACT

Concept definitions play an important role in mathematics education, and constitute the backbone of mathematics (De Villiers, 1998; Furinghetti and Paola, 2002; Vinner, 1976); they are indivisable parts of mathematics (MEB, 2013). Problem solving, proving, mathematical generalizations are as important as many mathematical activities, and the basis of these activities is the ability to understand the concept definitions (De Villiers, 1998). Usiskin and Griffin examine the definitions in two groups as inclusive and exclusion. If a definition does not include the content of the other definition, the definition is called exclusion definition; if a definition includes the content of another definition, it is called inclusive definiton.

The aim of this study is to examine the definitions by teacher candidates about parallelogram and rhombus. Phenomenology design, one of the qualitative research methods, has been used in the study. Phenomenology is a pattern used to investigate cases that we encounter in daily life, which we are aware of but we do not understand deeply and in detail (Yildirim & Simsek, 2018). The study has been conducted with 86 teacher candidates studying at the Department of Primary School Mathematics Teacher Program in 2018-2019 Academic Year. The data obtained from the study have been analyzed using descriptive analysis. In descriptive analysis, data is coded according to predetermined themes (Yildirim & Simsek, 2018). In this respect, the analysis themes covers the inclusive and exclusion definitions of rhombus and parallelogram. The data obtained have been coded according to these themes.

As a result of the study, it is concluded that the teacher candidates knew what the inclusive and exclusion definitions meant, but they are confused with the definitions and characteristics, and write feature instead of definition. Even if parallelogram has only one exclusion definition, a large number of definitions have been written, and it is determined that most of these definitions are features. In the definition of rhombus and

parallelogram, teacher candidates have written most of the definitions according to polygon feature of these. In addition, missing and incorrect definitions have mostly seen in the definitions done according to polygon feature. The exclusion definition made according to the symmetry feature of the rhombus has never been made. Also, according to the results, there is no missing and incorrect definition in the inclusive definition according to the diagonal feature of the parallelogram.

Key Words: Rhombus, parallelogram, definition.
MSC : 97.

REFERENCES

[1] De Villiers, M. (1998). To teach definitions in geometry or teach to define? In A. Olivier & K. Newstead (Eds.), Proceedings of the Twenty-second International Conference far the Psychology of Mathematics Education, University of Stellenbosch: Stellenbosch, 2, 248- 255.

[2] Furinghetti, F. & Paola, D. (2002). Defining within a dynamic geometry environrnent: Notes from the classroom. Proceedings of the 26th conference of the International Group far the Psyhology of Mathematics Education. Norwich, UK. 2, 392-399.

[3] Milli Eğitim Bakanlığı. (2013). Secondary mathematics lesson 5-8. classes curriculum. Ankara: Board of Education and Training

[4] Usiskin, Z. & Griffin, J. (2008). The classifıcation of quadrilaterals: A study in definition. Information Age Publishing, ine.

[5] Vinner, S. (1976).The naive conception of definition in mathematics. Educational Studies in Mathematics, 7(4), 413- 29.

[6] Yıldırım, A. , Şimşek, H. (2018). Qualitative research methods in the social sciences. Ankara: Seçkin Publication.

Virtual manipulative development for 6th grade in integer teaching

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ABSTRACT

The purpose of this study is presenting the "virtual manipulative", which is developed originally by the researcher. The material is based multiple representation. It presents solutions to the problem of learning the concept of and operations in integers through models used in teaching integers for primary school 6th grade students.

The manipulative has been developed in light of the mathematical definition the concept of integer and it enables the modeling of an integer as an ordered pair. According to this definition:

The set defined as $\{(\overline{a,b}) : (a,b) \in \mathbb{N}x\mathbb{N}\}$ equilibrium being $(\overline{a,b})$ according to $\sim$ relation defined as "for $(a,b)\sim(c,d)$ on $\mathbb{N}x\mathbb{N}$ set, if and only if $a+d=b+c$" is called as set of integers and $(\overline{a,b})$ is an integer If $(a,b),(c,d) \in \mathbb{N}x\mathbb{N}$, then $(\overline{a,b})+(\overline{c,d})=(\overline{a+c,b+d})$.

Additionally, if $(\overline{a,b}) \in \mathbb{Z}$, then opposite of $(\overline{a,b})$ under addition is $(\overline{b,a})$ and so $-(\overline{a,b})=(\overline{b,a})$ (Argün, Arıkan, Bulut, & Halıcıoğlu, 2014; Baki,2018).

Also, it provides alternative modeling for addition and subtraction operations.

This manipulative includes counters for ordered pairs and their integer equivalents. Presenting an integer's potential positive and negative cases is possible.

In this context, it is hoped that the use of infinite equivalent forms of numbers by the manipulative is important for the development of the sense of number. Also we see in many studies (Dienes,2000; Nesin, 2010; Whitacre, Bishop, Lamp, Philipp, Schappelle & Lewis, 2012) this definition for using model in accordance with integer teaching.

Key Words: virtual manipulative, integer teaching, 6th grade.

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MSC: 97.

REFERENCES

[1] Argün, Z., Arıkan, A., Bulut, S., & Halıcıoğlu, S. (2014). Mastery of basic mathematical concepts. Ankara: Gazi Bookstore.

[2] Baki, A. (2018). Knowledge of teaching mathematics. Pegem Academy, Ankara.

[3] Dienes, Z.P.(2000). The theory of the six stages of learning with integers. Mathematics in School, 29(2): p. 27-32.

[4] Nesin, A. (2010). Construction of Numbers. TÜBA Open Course Materials

[5] Whitacre, I., Bishop, J. P., Lamb, L. L., Philipp, R. A., Schappelle, B. P., & Lewis, M. L. (2012). Happy and sad thoughts: An exploration of children's integer reasoning. The Journal of Mathematical Behavior, 31(3), 356-365.

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The Examination of Secondary School Mathematics Teachers' Geometry-Based Courses in the Context of Geometric Reasoning Processes

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ABSTRACT

In this study, it is aimed to reveal the current behavior of teachers in the context of cognitive and perceptual processes in geometry teaching and to evaluate how these concepts are emphasized. In order to analyze the cognitive and perceptual processes related to geometry teaching and to contribute to the teaching of geometry, the video recording of the five mathematics teachers was analyzed according to the theoretical framework of geometric reasoning defined by French psychologist Raymond Duvall (1995). In this study, case study pattern, which is one of the qualitative research methods, is used in accordance with the nature of the study. The data obtained from video recordings were analyzed by descriptive analysis method. For the descriptive analysis, the analysis framework defined in Duvall (1995) and defined by Güven and Karpuz (2016) was used. According to the findings obtained from the research, it was seen that the most emphasis was on visualization and reasoning code of the mathematics teachers' courses with geometry. Duval, visualization code and visual perception code; The code of creation and the sequential code of identification support each other. In addition, there is no hierarchical structure between the codes in the cognitive and perceptual process categories, but the codes can be independent of each other and interact with each other simultaneously (1995). In this respect, it is seen that the geometric reasoning processes of the teachers whose videos are analyzed coincide with the theoretical framework of Duval. Undoubtedly, all these processes Duval put forward, the students can make geometric inferences, using theorems and geometrical properties, to develop their spatial abilities, geometric skills, imagination and geometric insights,

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to be able to discover the transformations between geometric models and to connect the concepts play.

Key Words: Geometry teaching, geometric reasoning, cognitive processes and perceptual processes.

MSC: 97.

REFERENCES

[1] Duval,R.(1995).Geometrical Pictures: Kind of representation and specific processing's.(edit. R. Sutherland, J. Mason) Exploiting mental imagery with computers in mathematics education (pp.142-156).Berlin: Springer.

[2] Güven B. Karpuz Y. (2016). Geometric Reasoning: Cognitive Perspectives. Bingölbali, E., Arslan, S., & Zembat, İ.Ö. (Ed.), Theories in Mathematics Education (pp.245-263) Ankara: Pegem Academy.

The integration of information and communication technologies for education: Comparative analysis of Turkey and Singapore

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ABSTRACT

The integration of information and communication technologies into education has become increasingly important in recent years. Especially with the revolution of industry 4.0, digital transformation in education has accelerated. Therefore, this transformation has shaped the educational policies of many countries. National and international economic or political environments, educators, academics, students, parents, society and scientists are effective in determining these policies. As a result, they have different expectations about how the integration process should be in education. This diversity reveals the necessity to address all these differences in a holistic way in order to better understand the integration process and its effects.

In this study, it was aimed to reveal the purpose, policies and practices of information and communication integration in education, its effects and criticisms directed to the effects compared with Turkey and Singapore. The level of development of the countries and the results of Pisa (The Program for International Student Assesment) were effective in sample selection. For this purpose, ICT integration aims and policies of both countries, changes in ICT practices in the process, educational reforms, important implementations and criticisms of the process were discussed.

As a result of the document reviews, ICT integration in education was analyzed in three different periods. It can be said that policies followed during the period of 1980-1990 are aimed at raising awareness of the ICT skills of the society, developing ICT skills in the period of 1990-2010, and raising individuals who use ICT skills in the fields of environmental, social and economic fields in 2010 and beyond.

However, there are findings and discussions about the impact of ICT integration in education on the differentiation of countries subject to comparison, especially in

PISA results. According to all these results, the reflection of ICT integration in education in societies has been addressed and made several suggestions for educational policies of countries.

Key Words: ICT, technology integration, education system, comparative analysis, Turkey, Singapore.

MSC : 97

REFERENCES

[1] Akbaba-Altun, S. Information Technology Classrooms and Elementary School Principals' Roles: Turkish Experience, Education and Information Technologies (2004) 9: 255.

[2] OECD, Are Students Ready for a Technology-Rich World?: What PISA Studies Tell Us. Paris, OECD, 2006.

[3] OECD, The OECD Handbook for Innovative Learning Environments, OECD, Publishing, Paris, OECD, 2017.

[4] Singapore Ministry of Education. (1997). Speech by Radm Teo Chee Hearty Minister for Education and 2nd Minister for Defence at the launch of the masterplan for it in education on monday 28 april 97 at Suntec City at 10 am opening new frontiers in education with information technology.

[5] Singapore Ministry of Education. (2002). Speech by Mr Thar- man Shanmugaratnam, Senior Minister of Statefor Trade and Industry & Education at Itopia 2002.

[6] Singapore Ministry of Education. (2008). Opening address by Dr Ng Eng Hetty Minister for Education and Second Minister for D fence, at the International Conference on Teaching and Learning with Technology (iCTLT) at the Suntec Convention Hall, on Tuesday, 5 August 2008

[7] Singapore Ministry of Education (2010). Building a national education system for the 21st century: The Singapore experience. Presented at the Building Blocks for Education: Whole System Reform Toronto, September 2010.

[8] Singapore Ministry of Education. (2010b). MOE, IDA and Microsoft launch cyber wellness student ambassador programme.

A mind-picking comparative study used by elementary school students in the 2nd and 3rd grade: Prospective longitudinal study

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ABSTRACT

The aim of this research is to determine whether or not there is a change in the mental addition strategies of students from grade 2 to grade 3. A practical solution therefore could be deployed as a solution to problems encountered in our everyday lives using mental calculation (i.e addition, subtraction, division and multiplication). Mental addition amongst the four mention procedures is the easiest of them all. Mental addition serves as basics and supports the teaching of the other three mental operations (Liu, Ding, Liu, Wang, Zhen, and Jiang, 2019). Mental addition is defined as the addition operation performance without the need of paper-pen or even technological tools (Van De Walle, Karp, & Williams 2016).

In this research, qualitative approach was used using case study of a descriptive statistics. Descriptive studies are studies that ensure natural condition of the data under investigation without causing any change to the data (Çepni, 2007). A case study approach is carried out to define, understand and describe the causes and consequences of situation. Case study allows the possibility of describing and examining details the real context of a research question with a defined boundaries (Ozan Leylum, Odabaşı and Kabakçı Yurdakul, 2017).

The study group consists of students in X school in Keçiören district in Ankara. First data were collected in the last week of April when the student were in their second grade with the second set of data collected similarly in the last week of April when the students were in third grade. Data collection were carried out using 8 questionnaire to allow the use of different strategies while collecting mental response from the students. The questionnaire was prepared in reference to the Mathematics Teaching Program of the Ministry of Education (MEB, 2018). A structure interviewing approach was used to interview 16 students in the study group as a mean to find the

solutions to the research questions. Each student was asked to perform the addition operation without using paper and pencil with each answers from the students recorded using a voice recorder. The collected data were then analysed using the Top Mental addiotion strategies table as quoted by Aydin and Karadeniz (2016) from Rey, Nohda and Emori (1995).

The findings revealed that, majority of the students performed their mental addition operation according to an algorithmic approach in the second grade and this pattern continued in the third grade as well. As a results, the use of different strategies at both grades in mental addition operation is quite low.

Key Words: Mental addition strategies, elementary school, longitudinal study

MSC: 97.

REFERENCES

[1] Aydın, F., Karadeniz, M. (2016). Examining the Mental Addition Strategies That Are Used by The Secondary School Students, *Ahi Evran University (KEFAD).* 17 (3), 621-639.

[2] Çepni, S. (2007). *Introduction to research and project studies* (3th Press). Trabzon: Üçyol Cultural Center Publications.

[3] Liu, R. D., Ding, Y., Liu, H., Wang, J., Zhen, R., & Jiang, R. H. (2019). Effects of Working Memory, Strategy Use, and Single-Step Mental Addition on Multi-Step Mental Addition in Chinese Elementary Students. *Frontiers in psychology*, *10*, 148.

[4] Republic of Turkish Ministry of National Education. (2018). *Mathematics Course (1-8th grades) curriculum*. Ankara.

[5] Ozan Leylum, Ş., Odabaşı, H. F., & Kabakçı Yurdakul, I. (2017). Importance of case study in educational environments, Journal of Qualitative Research in Education, 5(3), 369-385. www.enadonline.com DOI: 10.14689/issn.2148- 2624.1.5c3s.

[6] Van De Walle, J. A., Karp, K. S., & Bay-Williams, J. M. (2016). Elementary and Secondary School Mathematics (translation editor: Prof. Dr. Soner Durmuş) (translated by 7th press). *Nobel Academic Publishing, Ankara*.

The effect of mind-picking strategies teaching on mind-picking skills of 3rd grade students

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ABSTRACT

The aim of this study is to determine the effect of structured mental addition strategies teaching on the mental addition skills of primary school 3rd grade students. One key objective of mathematics program is to provide students with the skills to be able to perform calculative operation by heart or from their minds. Mental processing skills contribute to the enhancement of the development of the sense of numbers, prediction and mathematical logic skills. In addition, these sense of number awareness and mind-processing skills gained during the first year of school are so vital in the middle and high school year (McGuire, Kinzie & Berch, 2012; Yang & Li, 2013). Other literature reviewed no significant change in the mental operation skills of the students who passed from the 2nd grade to the 3rd grade. This study however, seeks the need to improve the student's mental operation skills.

In this study, a single group prior-test and post test experimental design was used The choice using the single group was intended to determine the effectiveness of an education approach, technique or strategy as an appropriate approach base on the nature of the research (Creswell, 2012). The participant of the study were given an 8 weeks training where students were taught 1-plus 2-plus, '0' operation, the importance of paired numbers, rounding up to 10, multiples of 5, intersection and union, ensuring addition constant and algorithmic operating strategies. The research deployed the use of student-centered approach and technique such as gamification, drama and peer learning to teach students. In order to reinforce the strategies learned, games that students can play with each other in the classroom were structured and adopted.

The study consist of 16 3rd grade students of X school in the Keçiören district in Ankara. The study group was determined appropriate for the study using a sampling

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method. A questionnaire approach was used as the method of data collection with 8 questions prepared allowing the use of different strategies while collecting the data. The Mathematics Teaching program of the Ministry of Education, Turkey (MEB, 2018) was taken into consideration. A structured interview was then carried out with the 16 student participants as a means to get their response to the research questions. Each student was asked to perform the addition operation without the use of paper and pencil and the answers to each question recorded on a voice recorder. The collected data were then analyzed using the Top mental addition strategies table by Aydin and Karadeniz (2016) from Rey, Nohda and Emori (1995) as reference.

In conclusion, students used the algorithmic operation strategy the most while making mental addition while the uses of the other strategies were very little. After students were given the training, it was observed that, even student who could use only one strategy during the pre-test section could now use at least five different strategies which increased the diversity of choice in the classroom. As a result, mind-picking strategies can be developed and enriched through mind-picking strategies training.

Key Words: Elementary school, mathematics teaching, mental operation strategies

MSC: 97.

REFERENCES

[1] Aydın, F., Karadeniz, M. (2016). Examining the mind gathering strategies used by secondary school students. *Ahi Evran University, (KEFAD).* 17 (3), 621-639.

[2] Creswell, J W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Boston: Pearson.

[3] McGuire, P., Kinzie, M. B. ve Berch, D. B. (2012). Developing Number Sense in Pre-K with Five-Frames. Early Childhood Education Journal (40), 213-222.

[4] Republic of Turkish Ministry of National Education. (2018). *Mathematics Course (1-8th grades) curriculum*. Ankara..

[5] Yang, D. C., Li, M. N. (2013). Assessment of Animated Self-Directed Learning Activities Modules for Children's Number Sense Development. Educational Technology & Society, 16 (3), 44-58.

Undergraduate student's views about creative thinking activities which applied in mathematics course

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ABSTRACT

In recent years, studies in the field of education emphasize the importance of students' 21st century skills. At the beginning of these skills come thinking and creativity. The aim of this study is to revealed undergraduate student's views about creative thinking activities which applied in mathematics course. The application was carried out with the first grade students studying at a vocational school in Konya. The study was designed with case study which is one of the qualitative research approaches. The activities performed during the applications were analyzed by content analysis and at the end of the application, student views were collected by interview too. As a result of the study, it was concluded that the students were positively affected by the creative thinking activities, gained different experiences, felt themselves valuable, their motivation and interest levels towards the course increased. Practitioner's observations also support these results. In addition, another observation of the practitioner's are that the students who have never attended the course have participated in the course and that their motivation for mathematics course has increased. For these reasons, it is suggested to use creative thinking activities in the courses.

Key Words: Mathematics education, creative thinking, student opinions.

MSC : 97.

REFERENCES

[1] ARSLAN S. (2017). Basic and General Mathematics (5th press). Ankara: Nobel.

[2] Doğan N. (2005). Creative Thinking and Creativity. Özcan Demirel (Ed.), New Directions in Education (pp.167-198). Ankara: PegemA.

[3] Kurnaz, A. (2019). Critical Thinking Teaching Activities Planning-Application and Evaluation. (3th press). Konya: Eğitim Publishing.

Mathematics education in secondary and high schools: Methodology and 21st century perspective

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ABSTRACT

Mathematics is an abstract science with axiomatic methodology. For example, in Euclidean geometry the basic notions are point, line and plane, and it is constructed on five groups of axioms. The fifth axiom (about parallel lines) is slightly longer and isn't a simple trusting proposition. For centuries, this axiom has been a research topic of mathematicians and has led to the emergence of non-Euclidean geometries.

Geometry, under the name planimetry, deals with lengths, areas and volumes of real objects. In such applications measurement is the ratio of the amount which have to be measured to the amount, chosen and specified as a standard unite. The standard unit of length is metre, which represents a definite physical quantity. In mathematics a measure is a function from a sigma-algebra to nonnegative real numbers, giving zero value to the empty set and satisfying the additivity property. The concept of length in real-world measurements corresponds to the Lebesgue measure defined on the Borel sigma-algebra of real numbers, where, single points, as well as finite and countable infinite sets of points have zero lengths. In the physical world the zero length is meaningless. Also, time of zero length is meaningless in realité. In the real-world we can newer fall in situations, like in Zeno paradox. The distance, that is, the length in the physical world is bounded from bellow. The minimum length is around,

$$L_p = \sqrt{\frac{2\pi hG}{c^3}}$$

where, under the sign of the square root there are the three constants of nature: Newton's constant G, which sets the strength of gravity; the speed of light c, which opens up the extended present; and Planck's constant h, which determines the scale of the quantum granularity. The length L_p is called the Planck length. Numerically, it is equivalent to approximately 10^{-33} centimetres (Rovelli 2017). Nowadays, the visualization of a black hole further confirmed one of the consequences of the

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mathematical model of our universe founded by Einstein in the 20th century. Let us remind that Galileo wrote "The universe is written in the language of mathematics, and its characters are triangles, circles, and other geometric figures".

The methodological basics and the abstractness of mathematics is different from any other branch of the science. Natural sciences as physics, chemistry and biology seen from methodological point of view are experimental sciences. In their methodology, like in mathematics, there are basic notions and principles (instead of axioms). There is no need to conform the principles experimentally. A new hypothesis in order to become as a law has to be verified experimentally (reminding theorems).

There is a broad consensus that we should foster 21st century skills. Mathematics education seems a perfect place to work on those skills, yet, which of the competencies that are assembled under the label 21st century skills can, and should, be fostered is still an open question. In addition to introducing 21st century skills in the school curriculum, changes will have to be made in content goals. This is especially the case for mathematics education (Gravemeijer at all 2016). However, in 21st century at the age of information, we need to think about how to use the virtual world's possibilities in mathematics education. Mathematics is mathematics and must be teach as mathematics.

Key Words: Curriculum, classroom instruction, dispositions, mathematical thinking.

MSC: 03, 51, 97.

REFERENCES

[1] H. Arıkan, Teaching and Learning Mathematics in Turkey, Proceedings of the 13th International Congress on Mathematical Education, ICME-13, Hamburg, Springer Open, 2016.

[2] R. Courant, H. Robbins, What is Mathematics? An Elementary Approach to Ideas and Methods (Second Edition), Oxford University Press, 1996.

[3] C. Cue, Making Middle School Maths Real, Relevant and Fun, Proceedings of the 13th International Congress on Mathematical Education, ICME-13, Hamburg, Springer Open, 2016.

[4] K. Gravemeijer, F.L. Lin, M. Stephan, C. Julie, M. Ohtani, Reconsidering Mathematics Education for the Future, Proceedings of the 13th International Congress on Mathematical Education, ICME-13, Hamburg, Springer Open, 2016.

[5] C.Rovelli, Seven Short Courses on Physics, Can Art Publications, İstanbul, 2017.

[6] Council of Higher Education, Teacher Training Undergraduate ProgramsElementary Mathematics Teacher Education Undergraduate Program, Mathematics Education Undergraduate Program,30 May 2018.

[7] G.M.Ziegler, A.Loos, "What is Mathematics?" and why we should ask, where one should experience and learn that, and how to teach it, Proceedings of the 13th International Congress on Mathematical Education, ICME-13, Hamburg, Springer Open, 2016.

Probability and statistics education in secondary and high schools: methodology and 21st century perspective

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ABSTRACT

The need for probability and statistics literacy has been recognised by educational authorities in many countries. Current situation about statistics and data analysis is our ability to generate, manage, and use massive amounts of data for scientific discovery and for making predictions about future events. However, probability and statistics should also come into play in the modelling phase of phenomena.

Isaac Newton brought to the world the idea of modelling the motion of physical systems with equations. After inventing the notion derivative he threw up the basics of Newtonian mechanics. Newtonian mechanics is deterministic in its methodology of inference and use mathematics as a modeling device. Quantum mechanics describes the universe at the atomic and subatomic levels and is based on Heisenberg's uncertainty principle. It is stochastic in its essentials and use probability theory and statistics as a modeling language, besides mathematics.

Let us notice that the concept of measuring and evaluation of measurements is a statistical topic. The first attempt in this direction is the development of theory of errors, where uncertainties in measurements have to be taken into account in the interpretation of results. The second stage is the characterization of observed phenomena in terms of laws of randomness governing a physical system. How can we understand the uncertainties behind measurements or randomness in physical systems? The answer is: Use Probability and Statistics.

Statistics as a science continuing to have a tremendous surge in popularity. Increased attention must be paid to the development of curricula and training programs that adequately prepare students for the modern work. Statistical literacy increasingly is considered as an important outcome of schooling. Even though it seems clear what it's need to teach, the pedagogical challenge is how to teach all of these topics so that

students would actually learn the material and be job ready. The demand for well-trained statisticians continues to grow.

Today, statistical knowledge is just as important as literacy and statistical education should begin at an early age. Because of this requirement, some statistical concepts and methods are included in the secondary and high schools curricula. Can mathematics teachers do this task? We will discuss on this.

Key Words: Statistics education research, statistical thinking.

MSC : 60, 62, 97.

REFERENCES

[1] R. Callingham, J.M. Watson, The Development of Statistical Literacy at School, International Association for Statistical Education, Statistics Education Research Journal, Volume 16, Number1, May 2017.

[2] J.B. Greenhouse, H.J. Seltman, On Teaching Statistical Practice: From Novice to Expert, The American Statistician, Vol.72, No.2, 147-154: Teacher's Corner, 2018.

[3] C.R. Rao, Statistics and Truth: Puting Chance to Work, World Scientific Publishing Co., 1997.

[4] L. Ziegler, J. Garfield, Developing a Statistical Literacy Assessment for the Modern Introductory Statistics Course, International Association for Statistical Education, Statistics Education Research Journal, Volume 17, Number2, May 2018.

How to solve mathematics problem with autistic perspective?

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ABSTRACT

With the increasing the number of individuals with disabilities in recent years, the education to children in need of special education has become important. Special education is individualization of education in accordance with students to meet the needs unique to them (Turnbull, Turnbull, & Wehmeyer, 2007). An individual requiring special education is an individual who significantly differs from his/her peers in terms of his/her personal characteristics and educational competencies (Eripek, 1998, p. 3).

One of the objectives of the programs implemented in schools is to gain academic skills in mathematics. In particular, there are views that students' ability to become proficient in mathematics will help them advance in academic and professional fields. For children in needs special education is important teaching mathematics. Because such students suffer learning difficulties in mathematics and need special attention to gain basic mathematical skills (Geary, 1994, p. 156).

Vygotsky stated that children in need of special education are only educated according to the level of mental development they are in, and that therefore children never make a leap from concrete thought to the abstract in their educational processes. Accordingly, the threshold of education should always be higher than the child's level of development, since the child's mental potential will improve with education and lead to new levels of development. In this context, apart from the long-term goals that will be determined for the students with special education needs, it should be tried to show the necessary efforts to reach these high level targets by setting higher goals than possible, especially in the field of mathematics which can provide abstract thinking skills. (Vygotsky, 1978, p. 89, ctd. Erdener, 2009, p. 97-98).

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In this study, it was investigated how an autistic young person produces solutions to verbal mathematical problems requiring four operations. It was seen that this young person needs some clues during problem solving and it benefited from visual drawings especially in understanding. It was also identified that an autistic young person write similar questions to the given mathematics problem.

Key Words: Special education, mathematics problem solving, mathematics education.

MCS: 97

REFERENCES

[1] Erdener, E. (2009). The Arguments Of Vygotsky On Thought And Language: A Critical View To Piaget. The Journal of Turkish Educational Sciences, 7(1), 85-103.

[2] Eripek, S. (1998). *Special education. Eskişehir: Anadolu University*.

[3] Geary, D. C. (1994). *Children's mathematical development*: Research and practical applications. Washington, DC: American Psychological Association.

[4] Turnbull, A., Turnbull, R., & Wehmeyer, M. L. (2007). *Exceptional lives: Special education in today's schools.* Upper Saddle River, NJ: Prentice Hall.

Maths class that I dreamed: The designs of the classroom environment of the 5th grade students

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ABSTRACT

One of the important elements of education is the classroom environment in which education takes place. The classroom environment is a common living space in which educational activities are carried out in line with the predetermined objectives (Aydın, 2012) and it is a field in which the student can interact with the physical and social environment rather than the area where the ready-made information is presented. Therefore, classroom environments, which are seen as an important factor in student success, should be organized according to the conditions of the age (Köse and Küçükoğlu, 2019). In fact, students should be more active, construct their own knowledge and acquire cognitive skills (Verschaffel, Lasure, Vaerenbergh, Bogaerts and Ratinckx, 1999).

In this context, it is aimed to determine the design of classroom environment in the minds of the 5th grade students. For this purpose, the students who participated in the study were asked the focus question "What kind of maths class do you dream?" And they were asked to illustrate the class designs of their dreams and then give explanations about their drawings. In this way, students' perceptions of the mathematics classroom and their learning environment can be revealed.

The study, which was designed on the basis of qualitative research approach, was based on the case study. The participants of the study consisted of 44 students attending the 5th grade in a public school in Sakarya in 2018-2019 academic year. The student drawings and explanations for their drawings constitute the data source of the study. The data obtained were examined and evaluated by content analysis. According to the findings; the pictures drawn based to the focus question were analyzed regarding to the coding list of the design of classroom environment of students. The categories in this list are; *"equipment", "design", "sitting order",*

"number of students " and *"objects in the classroom."* Student drawings were evaluated according to the visual elements drawn and the explanations about the classroom designs presented in the following.

Key Words: Mathematics education, classroom design, qualitative approach.

MSC: 97

REFERENCES

[1] Aydın, A. (2012). *Classroom management.* 15th edition, Ankara: Pegem A Publishing.

[2] Köse, E., & Küçükoğlu, A. (2009). Evaluation of classroom learning environment in education faculties in terms of some variables. *Ahi Evran University Journal of Education Faculty,10*(3), 61-73.

[3] Verschaffel, L., De Corte, E., Lasure, S., Vaerenbergh, G. V., Bogaerts, & Ratinckx, E. (1999). Learning to solve mathematical application problems: A design experiment with fifth graders. *Mathematical Thinking and Learning,1*(3), 195-229.

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Developed a new Search direction in the conjugate gradient algorithms for unconstrained optimization

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ABSTRACT

In this study, we have developed a new conjugate gradient algorithm in field of scaled conjugate depending on classical conjugate gradient and Quasi-Newton algorithms. These algorithms (classical conjugate gradient) can be classified as algorithms with [$g_{k+1}^T \; g_{k+1}$] in the numerator of β_k and algorithms with [$g_{k+1}^T \; y_k$] in the numerator of parameter β_k. The (Quasi-Newton methods revolutionized non-linear optimization and then this method has become more popular. Finally, it has accepted as the best Quasi-Newton method, which defines the search direction as

$$d_k = -H_k g_k ,$$

where H_1 is taken as identity matrix and H_{k+1} restricted to satisfy the secant equation or (quasi- Newton condition).

The new direction involves the new hybrid scaled gradient algorithm that defines (have been devised to exploit the attractive features of the classical conjugate gradient algorithms). It's algorithms satisfies the descent direction and global convergence property under some assumptions. The numerical results indicates efficiency of the new algorithm for solving test unconstrained nonlinear optimization problems compared with classical algorithm. A new hybrid scaled conjugate gradient algorithm (where using for solving unconstrained optimization). The another method that using in our proposal for solving unimpeded optimization problem is spectral conjugate gradient. the spectral conjugate gradient defines the search directions as follows:

$$d_{k+1} = -\theta_{k+1} g_{k+1} + \beta_k d_k ,$$

where θ_{k+1} is a parameter, the iterative process is initialized with an initial point x_1 and $d_1 = -g_1$. observe that if $\theta_{k+1} = 1$. Then we get the classical CG algorithms according to the value of β_k.

Key Words: Three-term conjugate gradient, global convergence, large scale benchmark test.

MSC: 65, 68.

REFERENCES

[1] N. Andrei, An Unconstrained Optimization test function collection, Adv. Model. Optimization. 10, 147-161, 2008.

[2] N. Andrei, A simple three-term conjugate gradient algorithm for unconstrained optimization, Journal of Computational and Applied Mathematics, 241, 19–29, 2013.

[3] E. D. Dolan and J. Mor´e., Benchmarking optimization software with performance profiles, Math. Programming, 91, 201-213, 2002.

[4] L. Zhang and Y. Zhou, A note on the convergence properties of the original three-term Hestenes–Stiefel method, AMO-Advanced Modeling and Optimization, 14, 159–163, 2012.

Existence of positive solutions for mixed fractional differential equation with p-Laplacian operator

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ABSTRACT

Fractional calculus is an extension of classical calculus and deals with the generalization of integration and differentiation to an arbitrary real order. Boundary value problems for Caputo fractional differential equations, Riemann-Liouville fractional differential equations and mixed fractional differential equations of great importance for the researches due to their applications, such as physics, chemistry, probability, many other branches of engineering, etc(Podlubny 1993). The existence of positive solutions for fractional-order boundary value problems have become an important area of investigation in recent years. These studies use the fixed-point theory in cones. The differential equations with p-Laplacian operator have been background in physics. Therefore, boundary value problems of fractional differential equations with p-Laplacian operator have been greatly studied.

In this study, by using Avery-Peterson fixed point theorem, we establish the existence of at least three positive solutions for fractional order differential equation involving the Caputo fractional derivative and the Riemann fractional derivative (Lakoud,Khaldi, and Kılıçman 2017, Samko,Kilbas, and Marichev 1993). Our problem involves p-Laplacian operator is given by φ_p, where p >1. This operator is continuous, increasing, invertible and its inverse operator is φ_q, where q > 1 is a constant such that $\frac{1}{p}+\frac{1}{q}=1$ (Yang and Wang 2017). As an application, an example is included to demonstrate the main result.

Key Words: Caputo fractional derivative, Riemann-Liouville fractional derivative, Avery-Peterson fixed point theorem, positive solutions.

MSC: 34.

REFERENCES

[1] I.Podlubny, Fractional Differential Equations, Mathematics in Science and Engineering, Academic Press, New York (1999).

[2] Y. Li, Multiple positive solutions for nonlinear mixed fractional differential equation with p-Laplacian operator, Adv. Difference Equ., (2019) 2019:112.

[3] G.Samko, A.Kilbas, and O.Marichev, Fractional Integrals and Derivatives, Theory and Applications, Gordon and Breach, Switzerland (1993).

[4] Y.Liu, Application of Avery-Peterson fixed point theorem to nonlinear boundary value problem of fractional differential equation with the Caputo's derivative, Commun. Nonlinear Sci. Numer. Smul.,17 (2012),4576-4584

[5] A.Guezane Lakoud, R.Khaldi, and A.Kılıçman, Existence of solutions for mixed fractional boundary value problem, Adv. Difference Equ.. (2017) 2017:164.

[6] Y.Yang, Q.Wang, Multiple positive solutions for p-Laplacian equations with integral boundary conditions,J.Math.Anal.Appl. 453 (2017),558-571

Computation of isotopic distributions of hypernuclei in nuclear reactions via Monte Carlo method

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ABSTRACT

It is important to investigate the isotopic distributions of nuclei and hypernuclei in nuclear reactions since the excited heavy hyper residues in relativistic hadron and peripheral heavy-ion collisions using new technologies which are planned at FAIR and NICA. Recent experiments have confirmed observations of hypernuclei in both peripheral [1] and central collisions [2]. Nucleon-nucleon interaction is well known from elastic scattering data. There are not enough information about the hyperon-nucleon and hyperon-hyperon interactions in the literature. Because hyperons have very short life times and yields are very low in experiments. A hyperon can be put deep inside an atomic nucleus. There is no Pauli blocking by the nucleons for hyperons due to their strangeness number. That is why hyperons can be used as a sensitive probe of the nuclear interior. We have studied isotopic distributions of light nuclei and hypernuclei via using the Statistical Multifragmentation Model (SMM)[3,4]. During the statistical calculation processes for normal nuclei and hypernuclei as the decay channels we have used Monte Carlo Method. We show how the new decay channels can be integrated in the whole disintegration process. We emphasize that isotope distributions of produced hyper fragments is very important. In near future, new and exotic isotopes obtained within these processes may provide a unique opportunity for new experimental studies.

Key Words: statistical multifragmentation model, Monte Carlo Method, numeric analysis

MSC : 62, 65, 82.

REFERENCES

[1] T. R. Saito et al. (HypHI Collaboration), Production of hypernuclei in peripheral HI collisions: The HypHI project at GSI, Nuclear Physics A 881 (2012) 218.

[2] STAR Collaboration, Observation of an Antimatter Hypernucleus. *Science* 328 (2010) 58.

[3] Buyukcizmeci, N., Botvina, A.S., Pochodzalla, J. and Bleicher, M. Mechanisms for the production of hypernuclei beyond the neutron and proton drip lines, Phys. Rev. C, 88 (2013) 014611.

[4] Buyukcizmeci, N., Botvina, A.S., A. Ergun, R.Ogul and Bleicher, Phys. Rev C **98** (2018) 064603.

Expansion dynamics of interacting bosons on various optical lattices

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ABSTRACT

Recent developments in experimental techniques have allowed precise control over the properties of ultracold atomic gases in traps and optical lattices, turning them into a simulation tool for quantum many body systems and allowing experimental investigation of static and dynamic behaviour of clean and low dimensional systems. Loading of a Bose Einstein Condensate onto an optical lattice leads to new kinds of physical phenomena. Such systems can be considered as experimental realizations of Hubbard-type models and can be brought to a strongly correlated regime. Experimental techniques also allow the formation of different types of optical lattices is such as checkerboard lattice.

It was predicted by M. Fisher et. al. that the homogeneous Bose-Hubbard model (BH) exhibits the Superfluid-Mott insulator (SF-MI) quantum phase transition [1]. This phase transition was observed experimentally by M. Greiner et.al. [2]. Later studies of BH models with interactions extended to nearest neighbors had pointed out that novel quantum phases, like supersolid (SS) and checkerboard phases (CB) are expected [3,4,5].

We consider a system of bosons on a 2D checkerboard optical lattice. Such a system can be described by the well known Bose-Hubbard Hamiltonian. We study the problem in the mean-field regime, with an approach based on the Gutzwiller ansatz. This corresponds to writing the wave function as a product over different lattice sites of single-site wave functions.

$$|\psi\rangle = \prod_i \sum_n f_n^i \, |n\rangle_i$$

However, this wave function does not directly include the effects of correlations. We account for the correlations in an indirect way by using an effective correlation potential acting between the nearest neighboring sites. This results in a total Hamiltonian

$$\hat{\mathrm{H}} = -J\sum_{i,j}\left(\hat{a}_i^{\dagger}\hat{a}_j + \hat{a}_j^{\dagger}\hat{a}_i\right) + \frac{U}{2}\sum_i \hat{n}_i(\hat{n}_i - 1) + \frac{V_{cor}}{2}\sum_{i,j}\hat{n}_i\hat{n}_j + \sum_i (V_i - \mu)\hat{n}_i$$

where V_{cor} is the correlation potential and V_i is the lattice potential.

Dynamic analysis of this system requires the solution of a large set of coupled differential equations. We solve this coupled set of equations using the well known 4th order Runge-Kutta Method [6]. We present our results for various interaction strengths, various effective correlation potentials and for various potential depth differences of the checkerboard potential. Our results for the homogeneous optical lattice are in good agreement with the experimental results when the effective correlation potential is sufficiently strong.

Key Words: Supersolid, Checkerboard Phases, Bose Einstein Condensate, Bose-Hubbard Model, Superfluid-Mott insulator.

MSC : 81VXX, 81-04.

REFERENCES

[1] M. P.A. Fisher, P. B. Weichman, G. Grinstein, D. S. Fisher, Boson localization and the superfluid-insulator transition. Physical Review B, 40, 1,1989.

[2] M. Greiner, O. Mandel, T. Esslinger, T. W. Hänsch, and I. Bloch, Quantum phase transition from a superfluid to a Mott insulator in a gas of ultracold atoms. Nature 415, 39-44 (2002).

[3] K. Góral, L. Santos, and M. Lewenstein, Quantum Phases of Dipolar Bosons in Optical Lattices. Physical Review Letters, 88, 170406 (2002).

[4] D. L. Kovrizhin, G. V. Pai, and S. Sinha, Density wave and supersolid phases of correlated bosons in an optical lattice. Europhysics Letters, 72, 162-168 (2005).

[5] P. Sengupta, L. P. Pryadko, F. Alet, M. Troyer, and G. Schmid, Supersolids versus Phase , Separation in Two-Dimensional Lattice Bosons. Physical Review Letters 94, 207202 (2005).

[6] G. Dahlquist, A. Björck, Numerical Methods, (Translated by N. Anderson), pp.346, Prentice Hall International Inc. (1974).

Calculation of binding energies of hypernuclei in nuclear reactions

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ABSTRACT

Recently, hypernuclei coming from fragmentation and multifragmentation of spectator residues obtained in relativistic heavy ion collisions were investigated. Our aim is to find out binding energies of hypernuclei which can appear in nuclear reactions. We have compared two different mass formulae for the production of hypernuclei and their properties. The effect of addition of a single lambda in a non-strange normal nucleus is investigated through lambda separation energies. In this way, one can distinguish between different mass formulae of hypernuclei. For this purpose, we have used the statistical multifragmentation model version for hyperons (hyper-smm)[1,2]. During the statistical calculation processes for normal nuclei and hypernuclei, we have used Monte Carlo Method to obtain decay channels. We have made step by step calculations for numerical analyses to get information about binding energies of hypernuclei. These kind of investigations give us the opportunity to understand the properties of exotic hypernuclei in the future. These studies may also be important for probing the nucleon-hyperon and hyperon-hyperon effective interactions in microscopic calculations to obtain macroscopic properties of the nuclear collisions. We need the extracted information from the analyses of new experiments to study exotic nuclei and hypernuclei far from stability and to understand the nuclear composition in astrophysical objects. We believe that our study is also important to extend theoretical calculations.

Key Words: statistical multifragmentation model, Monte Carlo Method, numeric analysis

MSC : 62, 65, 82.

REFERENCES

[1] Buyukcizmeci, N., Botvina, A.S., Pochodzalla, J. and Bleicher, M. Mechanisms for the production of hypernuclei beyond the neutron and proton drip lines, Phys. Rev. C, 88 (2013) 014611.

[2] Buyukcizmeci, N., Botvina, A.S., A. Ergun, R. Ogul and Bleicher, Phys. Rev C **98** (2018) 064603.