Coupled Finite and Boundary Element Adaptive Approximations for the Problems of Elasticity

Ivan Dyyak
Ivan Franko National University of L'viv,
Dean of Applied Mathematics & Informatics Faculty,
ivan.dyyak@lnu.edu.ua

ABSTRACT

Heterogeneous modeling using finite and boundary element methods based on the domain decomposition method (DDM) we used for an algorithm of investigation linear and nonlinear problems of the elasticity theory. The variant of DDM without of intersection of the subdomains for finite element method (FEM) and direct boundary element method (DBEM), and DDM with intersection of the subdomains for FEM and undirect boundary element method (UBEM) were constructed.

For the problems of the theory of elasticity were constructed the heterogeneous approaches for objects with thin coating and elastic inclusions. Local elastic-plastic fracture mechanic problem was solved with combined schemes. Completely parallel schemes were built for contact problems without friction. We proposed the numerical solution of these problems on the base of an iterative DDM (Dirichlet-Neumann scheme). The theory of Poincare–Steklov operators was used for investigation the convergence of the algorithms. An approach was developed allows us to perform a parallelization of computations, starting with the input information for each subregion, constructing a grid of finite or boundary element, forming local matrices in each of the subregions and solving the system of linear equations on each iteration of the linearization of a nonlinear problem. The algorithms were implemented with C ++ using parallel MPI library.

We proposed *h*–adaptive scheme error estimator for these problems which is based on comparison of FEM and BEM the stress results. The numerical analysis of the problems with isoparametric approximation and mortar functions has indicated that the mesh refinement performed by the algorithm, correctly reveals singularities of stress field near the contact area, and the total number of variables decreases considerably compared to uniform mesh case. The results of testing the proposed

approach for modeling example are confirmed the perspective of the proposed approaches. The validity of the algorithms was verified by solving the model problems.

Key Words: *h*–adaptive finite element method, boundary element methods, domain decomposition methods.

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