

## Ivan Franko National University of L'viv

### Numerical methods for the singularly perturbed and evolutionary problems of physics and mechanics

Scientific supervisor: prof. Shynkarenko Heorhiy Andriyovych

#### Abstract

I) Classes of correctly formulated variational problems of heat conductivity in thin-walled constructions, acoustic interaction of fluid with elastic bodies and shells, diffusions-advection-reaction of substance in incompressible medium, piezoelectricity and thermal stresses are investigated. The proof and converging charts of method of finite elements are built for the decision of two- and three-dimensional variational problems, in particular, with the use of exponential approximations. Created a posteriori estimators of errors of FEM's approximations, strategies of h-adaptation of structure of approximations with the set permissible error, compatible stabilized schemes for singularly perturbed problems with dominant convection. The object-oriented application packages are developed.

II) Algorithms of an estimation of the sizes and a site of inclusion in in part - unlimited area on a plane are developed. The approached charts are built for the decision of inverse problems of reconstruction of cracks in in part - unlimited areas. We proved convergence of iterative process with supersquare-law convergence for the decision of the nonlinear equations in a case when in Lipschitz's conditions positive integrated function is used.