DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

(State the objective of the project, describe the research to be carried out, and present reasons for choosing the research topic.)

The objective of the project is to develop new mathematical tools and methods for the theoretical study of problems for various hemivariational inequalities and apply these theoretical results to nonsmooth contact problems in mechanics. The objective will be achieved through accomplishment of the following goals.

(1) Provide an exhaustive research on a class of *generalized elliptic variational-hemivariational inequalities* which may serve as variational formulations of the frictional contact problems with a unilateral constraint and the stationary Navier-Stokes equations involving a constraint set and nonlinear boundary conditions described by the Clarke subdifferential. The following issues will be addressed: existence, uniqueness and regularity of solution, continuous dependence of the solution on the data of the problem, including the dependence on the perturbation parameters. A penalty-regularization method will be introduced and its convergence will be studied.

(2) Deliver new results on a class of *history-dependent variational-hemivariational inequalities of parabolic type*. Results on existence, uniqueness, and numerical approximation, including construction of computational schemes and error estimates for such inequalities will be provided. An application to quasistatic viscoelastic contact problem with history-dependent friction bound, the Coulomb friction and relaxation term will be given.

(3) Investigate a new class of problems in an infinite dimensional Banach space, called *differential hemivariational inequalities of hyperbolic type*. Results on their well posedness, solution regularity and numerical approximation will be proved. An application to a system describing a dynamic viscoelastic frictional contact problem with adhesion will illustrate the theoretical results.

There are many reasons motivating the implementation of the project, e.g.,

(1) most open real-life problems of mechanics are nonsmooth,

(2) the use of techniques of functional analysis and differential equations in development of rigorous methods in mechanics is insufficient,

(3) project is driven by the insight that the problems located at the cutting edge of an area of contact mechanics cannot successfully be solved by already existing mathematical tools but need new modeling tools, mathematical and numerical methods,

(4) investigators are strongly interested in the project topics.