Optimal control of a viscoelastic contact problem described by an evolution hemivariational inequality

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Abstract

In this paper we study the optimal control problem for a hemivariational inequality of hyperbolic type. Such inequality describes a mechanical frictional contact problem of viscoelasticity with the Kelvin-Voigt constitutive law and multivalued boundary conditions which are expressed in terms of the Clarke subdifferential. The subdifferential relations hold, the first one between the normal component of the displacement and the normal component of the stress and the second one between the tangential component of the velocity and the tangential component of the stress. These boundary conditions are natural generalizations of the normal compliance contact condition and the normal damped response condition, respectively.

First, the mathematical model for the contact problem is formulated. Because of multivalued boundary conditions we embedd the problem into a more general class of problems for second order evolution inclusion. The existence of solutions to the inclusion is proved by exploiting a surjectivity result for operators of pseudomonotone type. Next the uniqueness of solutions to hyperbolic hemivariational inequality is showed for a large class of operators of subdifferential type satisfying a relaxed monotonicity condition. Then for optimal control problem for systems driven by hemivariational inequalities we develop an existence theory. Finally we obtain a result on a variational stability of optimal solutions to the control problem under perturbations which appear in boundary conditions.