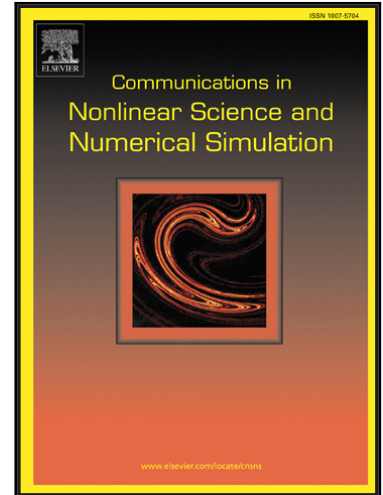


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A Class of Time-Fractional Hemivariational Inequalities with Application to Frictional Contact Problem *

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Abstract. In this paper a class of elliptic hemivariational inequalities involving the time-fractional order integral operator is investigated. Exploiting the Rothe method and using the surjectivity of multivalued pseudomonotone operators, a result on existence of solution to the problem is established. Then, this abstract result is applied to provide a theorem on the weak solvability of a fractional viscoelastic contact problem. The process is quasistatic and the constitutive relation is modeled with the fractional Kelvin-Voigt law. The friction and contact conditions are described by the Clarke generalized gradient of nonconvex and nonsmooth functionals. The variational formulation of this problem leads to a fractional hemivariational inequality.

Key words. Hemivariational inequality, Rothe method, Clarke subdifferential, Caputo derivative, fractional viscoelastic constitutive law, friction.

2010 Mathematics Subject Classification. 35L15, 35L86, 35L87, 74Hxx, 74M10.

1 Introduction

It is well known from rheology that the idealized elastic and viscous properties of the substance are modeled with two elements, the linear spring and Newton dashpot, respectively, which obey the laws of the form

$$\sigma_e = E \varepsilon_e \text{ (Hooke's law)} \quad \text{and} \quad \sigma_v = \eta \dot{\varepsilon}_v \text{ (Newton's law)},$$

respectively. Here, the coefficient $E > 0$ is Young's modulus of elasticity, σ_e and ε_e are the stress and strain of the linear spring element, respectively, $\eta > 0$ is the Newtonian

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