Nonlinear Dynamics and Systems Theory, **22** (5) (2022) 473–488

Analysis of an Antiplane Thermo-Electro-Viscoelastic Contact Problem with Long-Term Memory

L. Benziane * and N. Lebri

Applied Mathematics Laboratory, Department of Mathematics, Setif 1 - University, 19000, Algeria.

Received: May 6, 2022; Revised: October 10, 2022

Abstract: We study a mathematical problem modeling the antiplane shear deformation of a cylinder in frictionless contact with a rigid foundation. The material is assumed to be thermo-electro-viscoelastic with long-term memory, the friction is modeled by Tresca's law and the foundation is assumed to be electrically conductive. We derive a variational formulation for the model which is in the form of a system involving the displacement field, the electric potential field and the temperature field. We prove the existence of a unique weak solution to the problem. The proof is based on the arguments of time-dependent variational inequalities, parabolic inequalities, differential equations and a fixed point theorem.

Keywords: *weak solution; variational formulation; antiplane shear deformation; thermo-electroviscoelastic material; Tresca's friction law; fixed point; variational inequality.*

Mathematics Subject Classification (2010): 74M10, 49J40, 70K70, 70K75.

1 Introduction

Anti-plane shear deformation problems arise naturally from many real world applications such as rectilinear steady flow of simple fluids [6], interface stress effects of nanostructured materials [10], structures with cracks [16], layered/composite functioning materials [15], and phase transitions in solids [17]. Considerable attention has been paid to the modelling of such kind of problems, see for instance [8] and the references therein. In particular, the review paper [8] deals with modern developments for the antiplane shear model involving linear and nonlinear solid materials, various constitutive settings and applications. Antiplane frictional contact problems are used in geophysics in order to

* Corresponding author: mailto:la.benziane@yahoo.fr

© 2022 InforMath Publishing Group/1562-8353 (print)/1813-7385 (online)/http://e-ndst.kiev.ua