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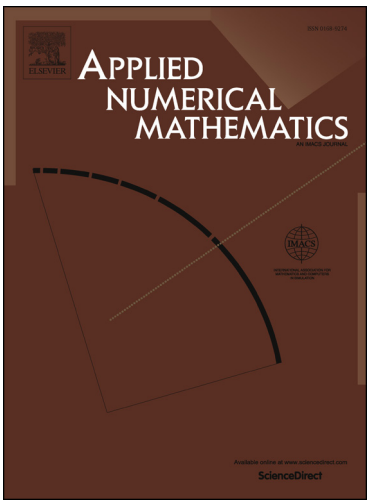

A dynamic contact problem for a thermoelastic diffusion beam with the rotational inertia

M. Aouadi, M.I.M. Copetti

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A dynamic contact problem for a thermoelastic diffusion beam with the rotational inertia.

M. Aouadi[a], M. I. M. Copetti*[,b]

[a] *Université de Carthage, UR Systèmes dynamiques et applications, UR 17ES21 Ecole Nationale d'Ingénieurs de Bizerte, 7035, BP 66, Tunisia*
[b] *Laboratório de Análise Numérica e Astrofísica, Departamento de Matemática Universidade Federal de Santa Maria, 97105-900, Santa Maria, RS, Brazil*

Abstract

We study the dynamic behaviour of a thermoelastic diffusion beam with the rotational inertia, clamped at one end and free to move between two stops at the other. The contact with the stops is modelled with the normal compliance condition. The system, recently derived by Aouadi [Applied Mathematics and Mechanics (English Edition) 36 (2015), 619-632], describes the behaviour of thermoelastic diffusion thin plates. This problem poses new mathematical difficulties due to the nonlinear boundary conditions. We prove the existence and uniqueness of weak solution using the Faedo-Galerkin method as well as the exponential stability at a rate proportional to the rotational inertia parameter. We propose a finite element approximation and we prove that the associated discrete energy decays to zero. Finally, we give an error estimate assuming extra regularity on the solution and we present some results of our numerical experiments.

Keywords: thermoelastic diffusion; beam; existence; exponential decay; numerical approximation.

1. Introduction

It is well known that beams that vibrate with high frequency may generate considerable heat and mass diffusion. For this reason, in this work we take into account the heat and mass diffusion generated during the process. The model includes dynamic vibrations of the beam and the associated generation of heat and mass diffusion; that is, the thermoelastic diffusion beam equations derived

*Corresponding author: Phone: 55(55)32208854. Fax:55(55)32208022.
Email addresses: monceaouadi00@gmail.com (M. Aouadi), mimcopetti@ufsm.br (M. I. M. Copetti)