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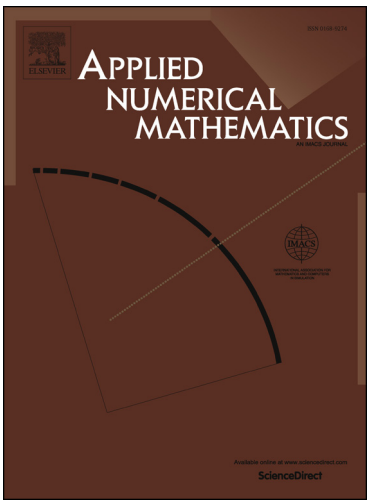

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Analysis of a dynamic contact problem with nonmonotone friction and non clamped boundary conditions [1]

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Abstract

We consider a dynamic process of frictional contact between a non clamped viscoelastic body and a foundation. We assume that the normal contact response depends on the depth of penetration of the foundation by the considered body, and the dependence between these two quantities is governed by normal compliance conditions. On the other hand, the friction force is assumed to be a nonmonotone function of the slip rate where the friction threshold also depends on the depth of the penetration. Our aim in this paper is twofold. The first one is to prove the existence and the uniqueness of a weak solution for the contact problem under consideration. The second one is to provide the numerical analysis of the process involving its semi-discrete and fully discrete approximation as well as estimation of the error for both numerical schemes and the validation of such a result.

Keywords: non clamped conditions, dynamic process, viscoelastic material, normal compliance, nonmonotone friction law, finite element method, error estimate.

2010 Mathematics Subject Classification: 65M15, 65M60, 74M10, 74M15, 74S05, 74S20.

1. Introduction

Mechanical contact phenomena occur in many branches of engineering sciences and everyday life. They appear for example when two or more parts of a device touch each other and in many other situations as well. The researchers take into account many various aspects when creating models of contact phenomena. For instance, physical parameters of materials, dynamics of the processes, phenomena like adhesion, wear, heat transfer, electrical conduction and friction provide a variety of possibilities in this field. As a consequence we are given a broad spectrum of complicated mathematical problems that require various mathematical techniques. Regarding this fact, one can confirm that mathematical modelling of contact problems has become an important and rapidly developing branch of science in last years. For recent mathematical results devoted to contact mechanics we refer to W. Han & M. Sofonea [17], M. Shillor *et al.* [29], M. Sofonea & A. Matei [30, 31] and all the

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