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# Recovery of a space-dependent vector source in anisotropic thermoelastic systems

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#### Abstract

We investigate the theoretical and numerical determination of a space-dependent vector source (load) in an anisotropic thermoelastic system of type-III form the knowledge of an additional final time measurement. The uniqueness of a solution to this inverse source problem is proved for various assumptions made on the convolution kernel. A convergent and stable iterative algorithm is proposed for the recovery of the unknown vector source in the linear case and, at the same time, a stopping criterion is also given. Three numerical experiments are considered to validate the properties of the proposed iterative procedure and the regularizing/stabilizing character of the corresponding stopping criterion. The numerical experiments carried out showed that it exists a certain limitation of the method with respect to the recovery of non-symmetric sources.

*Keywords:* anisotropic thermoelasticity, inverse problems, iterative regularization, discrepancy principle, finite element method

2010 MSC: 35Q61, 35K61, 35R09, 65M20, 82D55

#### 1 1. Introduction

In numerous practical applications related to nuclear power plants, engines and electronic devices, struc-2 tures of aircraft and propulsion systems, gas and steam turbines, or in chemical reactors, the effect of 3 thermo-mechanical loads acting on the solid body of interest must be studied and analyzed. In such sit-4 uations, thermal stresses may arise in a heated body because of a non-uniform temperature distribution, 5 external constraints, or a combination of these conditions. Also, the cooling and heating of a solid may be 6 associated with a change of volume and, consequently, the temperature distribution in the body is influenced 7 by the diagonal components of the strain tensor [1]. Green and Naghdi [2] described the heat flow in solid 8 bodies by employing a general entropy balance. According to these authors, the characterization of material 9 response for such thermal phenomena is referred to as type-I, type-II and type-III thermoelasticity. After lin-10 earization, the type-I thermoelasticity actually coincides with the classical heat conduction theory (Fourier's 11 law). This theory has the shortcoming that a thermal disturbance at one point of the body is instantly felt 12

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