

## INTERNAL STATE VARIABLES IN DIPOLAR THERMOELASTIC BODIES

M. Marin <sup>a \*</sup>, S. R. Mahmoud <sup>b c</sup>, and G. Stan <sup>a</sup>

Received 27:01:2012 : Accepted 03:10:2012

### Abstract

The aim of our study is prove that the presence of the internal state variables in a thermoelastic dipolar body do not influence the uniqueness of solution. After the mixed initial boundary value problem in this context is formulated, we use the Gronwall's inequality to prove the uniqueness of solution of this problem.

**Keywords:** thermoelastic, dipolar, internal state variables, uniqueness, Gronwall's inequality

*2000 AMS Classification:* 35A25, 35G46, 74A60, 74H25, 80A20

### 1. Introduction

Interest to consider the internal state variables as a means to estimate mechanical properties has grown rapidly in recent years.

The theories of internal state variables in different kind of materials represent a material length scale and are quite sufficient for a large number of the solid mechanics applications.

The internal state variables are the smallest possible subset of system variables that can represent the entire state of the system at any given time. The minimum number of state variables required to represent a given system,  $n$ , is usually equal to the order of the differential equations system's defining. If the system is represented in the transfer function form, the minimum number of state variables is equal to the order of the transfer function's denominator after it has been reduced to a proper fraction. It is important to understand that converting a state space realization to a transfer function form may lose some internal information about the system, and may provide a description of a system which is stable, when the state-space realization is unstable at certain points. For instance, in the electric circuits, the number of state variables is often, though not

---

<sup>a</sup>Dept. of Mathematics and Computer Science, Transilvania University of Brasov, Romania.

\*Corresponding author

<sup>b</sup>Department of Mathematics, King Abdulaziz University, Jeddah, Saudi Arabia.

<sup>c</sup>Department of Mathematics, Science Faculty, Sohag University, Egypt