

**International Conference Thermocon2016,**

**16-22 April 2016, Messina, Italy**

**A DERIVATION OF A GUYER-KRUMHANSL TYPE TEMPERATURE EQUATION IN CLASSICAL IRREVERSIBLE THERMODYNAMICS WITH INTERNAL VARIABLES**

VINCENZO CIANCIO <sup>a</sup> AND LILIANA RESTUCCIA <sup>a\*</sup>

ABSTRACT. In a previous paper, using the standard procedures of classical irreversible thermodynamics (CIT) with internal variables, we have shown that it is possible to describe thermal relaxation phenomena, obtaining some well-known results in extended irreversible thermodynamics (EIT). In particular, introducing two hidden variables, a vector and a second rank tensor, influencing the thermal transport phenomena in an undeformable medium, in the isotropic case, it was seen that the heat flux can be split in a first contribution  $\mathcal{J}^{(0)}$ , governed by Fourier law, and a second contribution  $\mathcal{J}^{(1)}$ , obeying Maxwell-Cattaneo-Vernotte equation (MCV), in which a relaxation time is present. In this contribution, using the obtained results, we work out a temperature equation, that in the one-dimensional case is a Guyer-Krumhansl type temperature equation, which contains as particular cases Maxwell-Cattaneo-Vernotte and Fourier temperature equations. Furthermore, in the case where  $n$  internal variables describe relaxation thermal phenomena, an analogous Guyer-Krumhansl type temperature equation is derived. The obtained results have applications in describing fast phenomena and high-frequency thermal waves in nanosystems.

---

<sup>a</sup> Università degli Studi di Messina Dipartimento di Scienze Matematiche e Informatiche, Scienze Fisiche e Scienze della Terra Contrada Papardo, 98166 Messina, Italy

\* To whom correspondence should be addressed | email: van.peter@wigner.mta.hu