EXPONENTIAL DECAY OF A HEAT POROUS THERMOELASTIC SYSTEM IN THE PRESENCE OF DISTRIBUTED DELAY WITHOUT FRICTIONAL DAMPING

Chaima Boulkheloua[1] and Houssem Eddine Khochemane*[2]

[1]Laboratory of Applied Mathematics and History and Didactics of Mathematics
(LAMAHIS)
University of 20 August 1955 Skikda, Algeria

[2]Ecole normal supérieure d'enseignement technologique-Skikda-Algeria
*Corresponding author.
E-mail: [1]c.boulkheloua@univ-skikda.dz / boulkchaima33@gmail.com,
[2]khochmanehoussem@hotmail.com

Abstract. In this paper, we consider a one-dimensional porous thermoelastic system with hereditary heat conduction and a distributed delay acting only on the porous equation without frictional damping, where the heat conduction is given by Gurtin Pipkin law. The existence and uniqueness of the solution are obtained by the use of Hille-Yosida theorem. Then, based on the energy method and by constructing a suitable Lyapunov functional, we prove under some assumptions on the derivative of the heat-flux kernel, that the solution of the system decays exponentially without any assumptions on the wave speeds.

Keywords. Porous thermo-elastic system, semigroup theory, exponential stability, Gurtin Pipkin law, energy method, distributed delay , absence of frictional damping.

AMS (MOS) subject classification: 35B40, 47D03, 74D05, 74F05.

1   Introduction

Over decades, numerous scientists and researchers have proposed various theories on thermoelasticity. In the classical heat diffusion theory, commonly referred to as classical thermoelasticity, heat flow is described by Fouriers law of thermal conductivity. This principle indicates that heat flow is proportional to the temperature gradient, and the thermal conductivity equation is defined by Fouriers law as:

$$q = -\kappa\theta_x, \tag{1.1}$$

where $\kappa > 0$ represents the coefficient of thermal conductivity of the material.

In the last thirty years, there has been a growing body of research on the analysis of the long-term behavior of porous thermoelastic systems. Casas