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THEORETICAL ANALYSIS AND NUMERICAL SIMULATION OF A HEAT BRESSE-TIMOSHENKO MODEL

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Abstract. In this article, we consider a one dimensional Bresse-Timoshenko beam model with microtemperature effect and viscous damping acting on the transverse displacement of the beam. We state and prove the global well-posedness of the problem by using the Faedo-Galerkin approximations along with some a priori estimates. We construct a suitable Lyapunov functional based on the multipliers method and we show that the energy decays in exponential manner irrespective on the wave speeds of the system or any other conditions on the system parameters. Finally, we present some numerical tests to illustrate the theoretical results by carrying out an Euler scheme for time discretization and the classical finite difference method for the spatial discretization.

Keywords. Bresse Timochenko system, microtemperature effect, exponential stability, Lyapunov functional, Faedo-Galerkin method, finite difference method.

AMS (MOS) subject classification: 35L70, 35B40, 93D20, 74D05, 93D15.

1 Introduction

In ([11], [12]), Elishakoff et al. gave a description of the beam vibrations model in one-dimensional case and this is due to his important applications in high technology of flexible structures. Historically, one of these models appeared in the Euler-Bernoulli beam theory, where it is assumed that the plane cross-sections which are perpendicular to the axis of the beam remain plane and perpendicular to the axis after deformation, which implies that