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Analysis for the strain gradient theory of porous thermoelasticity

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Abstract

In this paper, we analyze a model involving a strain gradient thermoelastic rod with voids. Existence and uniqueness, as well as an energy decay property, are proved by means of the semigroup arguments. The variational formulation is derived and then, a fully discrete approximation is introduced by using the finite element method to approximate the spatial variable and the implicit Euler scheme to discretize the time derivatives. A stability result and a priori error estimates are obtained, from which the linear convergence of the algorithm is deduced under suitable additional regularity conditions. Finally, some numerical simulations are presented to demonstrate the accuracy of the algorithm and the behaviour of the solution.

Key words: Strain gradient, thermo-elasticity, existence and uniqueness, exponential decay, finite elements, error estimates, numerical simulations.

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