Existence, Uniqueness and Exponential Decay: an Evolution Problem in Heat Conduction with Memory

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Abstract

A rigid linear heat conductor with memory conductor is considered. An evolution problem which arises in studying the thermodynamical state of the material with memory is considered. Specifically, the time evolution of the temperature distribution within a rigid heat conductor with memory is investigated. The constitutive equations which characterize heat conduction with memory, involve an integral term since the temperature's time derivative is connected to the heat flux gradient. The integro-differential problem, when initial and boundary conditions are assigned, is studied to obtain existence and uniqueness results. Key tools, turn out to be represented by suitable expressions of the minimum free energy which allow to construct functional spaces which are both meaningful under the physical as well as the analytic viewpoint since therein the existence and uniqueness results can be established. Finally, conditions which guarantee exponential decay at infinity are obtained.

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