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Asymptotic Estimates Related to an Integro Differential Equation

Monica De Angelis

University of Naples "Federico II", Dep. Math. Appl. "R.Caccioppoli", Via Claudio n.21, 80125, Naples, Italy.

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Abstract: The paper deals with an integrodifferential operator which models numerous phenomena in superconductivity, in biology and in viscoelasticity. Initial-boundary value problems with Neumann, Dirichlet and mixed boundary conditions are analyzed. An asymptotic analysis is achieved proving that for large t, the influences of the initial data vanish, while the effects of boundary disturbances are everywhere bounded.

Keywords: *initial-boundary problems for higher order parabolic equations; Laplace transform; superconductivity; FitzHugh-Nagumo model.*

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1 Introduction

If $u = u(x,t)$, let us consider the following integrodifferential equation

$$\mathcal{L}u \equiv \; u_t - \varepsilon u_{xx} + au + b\int_0^t e^{-\beta(t-\tau)}\, u(x,\tau)\, d\tau \;=\; F(x,t,u), \tag{1}$$

where ε, a, b, β are positive constants, x denotes the direction of propagation and t is the time. According to the meaning of $F(x,t,u)$, equation (1) describes the evolution of several linear or non linear physical models. For instance, when $F = f(x,t)$, (1) is related to the following linear phenomena:

- motions of viscoelastic fluids or solids [1–4];

* Corresponding author: mailto:modeange@unina.it