On a parabolic operator of dissipative systems

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The integro-differential operator $\mathcal{L}$

\[
\mathcal{L}u \equiv u_t - \varepsilon u_{xx} + a u + b \int_0^t e^{-\beta(t-\tau)} u(x, \tau) \, d\tau = F(x, t, u)
\]

which models several phenomena in viscoelasticity, biology and superconductivity is considered. Initial-boundary value problems with Neumann, Dirichlet and mixed boundary are analyzed and an asymptotic analysis is achieved. As example of equivalence among $\mathcal{L}$ and various reaction-diffusion systems, the Fitzhugh Nagumo model is considered and results are applied both in the linear case and in the non linear one.