Nonlinear evolution equations and application to mathematical models

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Abstract In this talk we consider initial-Neumann boundary value problem of nonlinear evolution equations with strong dissipation and proliferation arising from mathematical biology and medicine formulated as

$$(NE)\begin{cases} u_{tt} = D\Delta u_t + \nabla\cdot(\chi(u_t, e^{-u})e^{-u}\nabla u) + \mu_1 u_t(1-u_t) & \\ \qquad\qquad\qquad\qquad\qquad\qquad\qquad \textit{in} \ \ (x,t)\in\mathbf{\Omega}\times(0,\infty) & (1.1) \\ \dfrac{\partial}{\partial\nu}u|_{\partial\mathbf{\Omega}} = 0 \qquad\qquad \textit{on} \ \ \partial\mathbf{\Omega}\times(0,\infty) & (1.2) \\ u(x,0) = u_0(x), u_t(x,0) = u_1(x) \qquad \textit{in} \ \ \mathbf{\Omega} & (1.3) \end{cases}$$

where constants D, μ_1 are positive, $\mathbf{\Omega}$ is a bounded domain in R^n with a smooth boundary $\partial\mathbf{\Omega}$ and ν is the outer unit normal vector. Under appropriate regularity and boundedness conditions of the coefficient $\chi(u_t, e^{-u})$ of (1.1), we derive the energy estimate of (NE) and it enables us to show the global existence in time and asymptotic behavior of the solution. In the case of $\mu_1 = 0$ we studied the problem for a more restricted condition of $\chi(u_t, e^{-u})$ in [1]. In [2] our main concern is to seek the solution of the form of $u = t + v$. Our goal of this talk to consider other type of solutions to (NE), prticularly considering into the logtistic solution, or to study a more general case of (1.1). Finally we apply our result to mathematical models arising from biomedicine and discuss the behavior of cell migration.

Bibliography

[1] Kubo, A., *Nonlinear evolution equations associated with Mathematical models*, Discrete and Continuous Dynamical Systems, Supplement, 881-890 (2011).

[2] Kubo, A., Hoshino, H., *Nonlinear evolution equations with strong dissipation and proliferation*, to appear in the proceeding of 9th ISSAC conference.