Nonexistence of global solutions to a class of nonlinear wave equations with dynamic boundary conditions

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Abstract

We consider the problem $u_{tt}+\Delta^2 u+\delta u_t-\varphi(\int_\Omega |\nabla u|^2 dx)\Delta u = f(u)$, posed in $\Omega\times(0,T)$, with dynamical boundary conditions. Here $\Omega \subset \mathbb{R}^N$ is a an open smooth bounded domain. We prove, in certain conditions on f and φ that there is absence of global solutions. The method of proof relies on an argument of concavity.

1 Introduction and main result

The aim of the present note is to discuss some nonexistence result of global solutions to the problem

$$\begin{cases} u_{tt} + \Delta^2 u + \delta u_t - \varphi\left(\int_\Omega |\nabla u|^2 dx\right)\Delta u = f(u), & \text{on } \Omega\times(0,T), \\ u = 0, \quad \Delta u + p(\sigma)\frac{\partial u_t}{\partial \nu} = 0, & \text{in } \partial\Omega\times(0,T), \end{cases} \tag{1.1}$$

subject to the initial condition

$$u(x,0) = u_0(x), \quad u_t(x,0) = u_1(x), \tag{1.2}$$

for any $x \in \Omega$, where $\Omega \subset \mathbb{R}^N$ is an open smooth bounded domain, $\delta > 0$, $\frac{\partial}{\partial \nu}$ is the normal derivative on $\partial\Omega, p \geq 0$ is a smooth function defined on $\partial\Omega, f, \varphi, u_0$ and u_1 are given functions.

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