

Accepted Manuscript

Lower bounds for the blow-up time to a nonlinear viscoelastic wave equation with strong damping

Xiaoming Peng, Yadong Shang, Xiaoxiao Zheng



PII: S0893-9659(17)30248-3
DOI: <http://dx.doi.org/10.1016/j.aml.2017.08.003>
Reference: AML 5311

To appear in: *Applied Mathematics Letters*

Received date: 25 June 2017
Revised date: 3 August 2017
Accepted date: 3 August 2017

Please cite this article as: X. Peng, Y. Shang, X. Zheng, Lower bounds for the blow-up time to a nonlinear viscoelastic wave equation with strong damping, *Appl. Math. Lett.* (2017), <http://dx.doi.org/10.1016/j.aml.2017.08.003>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Lower bounds for the blow-up time to a nonlinear viscoelastic wave equation with strong damping

Xiaoming Peng^a, Yadong Shang^{b,*}, Xiaoxiao Zheng^c

^a*School of Statistics and Mathematics, Guangdong University of Finance and Economics, Guangzhou 510320, China*

^b*School of Mathematics and Information Science, Guangzhou University, Guangzhou 510006, China*

^c*School of Mathematical Sciences, Qufu Normal University, Qufu 273155, China*

Abstract

This paper deals with a nonlinear viscoelastic wave equation with strong damping. Under certain conditions on the initial data and the relaxation function, a lower bound for the blow-up time is given by means of a first order differential inequality technique.

Keywords: Lower bound, Blow up, viscoelastic, Strong damping

1. Introduction

In [1], Gazzola and Squassina considered the following initial-boundary value problem:

$$\begin{cases} u_{tt} - \Delta u - \omega \Delta u_t + \mu u_t = |u|^{p-2}u, & \text{in } \Omega \times [0, T], \\ u(x, t) = 0, & x \in \partial\Omega, \\ u(x, 0) = u_0(x), & u_t(x, 0) = u_1(x), \end{cases} \quad (1.1)$$

where Ω is an open bounded Lipschitz subset of \mathbb{R}^n ($n \geq 1$), $T > 0$, $\omega \geq 0$, $\mu > -\omega\lambda_1$, λ_1 being the first eigenvalue of the operator $-\Delta$ under homogeneous Dirichlet boundary conditions. They established global existence of solutions by the potential well method. In addition, not only finite time blow up for solutions starting in the unstable set is proved, but also high energy initial data for which the solution blows up are constructed. Recently, Sun et al. [2] obtained an estimate of the lower bound for the blow-up time by establishing first-order differential inequality when $2 < p \leq \frac{2(n-1)}{n-2}$. This work was extended by Guo and Liu [3] to the case when the exponent p lies in the interval $p \in (\frac{2(n-1)}{n-2}, \frac{2(n^2-2)}{n(n-2)}]$. Further, in the case of $\omega > 0$, by introducing a new auxiliary function Baghaei [4] obtained a lower bound for the blow-up time when $2 < p \leq \frac{2n}{n-2}$. This result improves the results obtained in [2, 3].

In presence of the viscoelastic term, the problem has been extensively studied and many results concerning global existence and nonexistence have been proved. For instance, for the equation

$$u_{tt} - \Delta u + \int_0^t g(t-\tau)\Delta u(\tau)d\tau + a|u_t|^{m-2}u_t = b|u|^{p-2}u, \quad (1.2)$$

where $p > 2$, $m \geq 1$, $a, b > 0$, and g is a positive nonincreasing function, it is well known that solutions with negative initial energy blow up in finite time if $m < p$ and continue to exist

*Corresponding author.

Email address: gzydshang@126.com (Yadong Shang)

Download English Version:

<https://daneshyari.com/en/article/5471505>

Download Persian Version:

<https://daneshyari.com/article/5471505>

[Daneshyari.com](https://daneshyari.com)