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# Decay Properties for the Damped Wave Equation with Space Dependent Potential and Absorbed Semilinear Term

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Pages 1402-1418 | Received 16 Dec 2008, Accepted 08 Mar 2010, Published online: 07 Jul 2010

Cite this article <https://doi.org/10.1080/03605302.2010.490285>

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## Abstract

We consider the Cauchy problem for the damped wave equation with space dependent potential  $V(x)u_t$  and absorbed semilinear term  $|u|^{\rho-1}u$  in  $\mathbb{R}^N$ . Our assumption on  $V(x) \sim (1 + |x|^2)^{-\alpha/2}$  ( $0 \leq \alpha < 1$ ) still implies the diffusion phenomena and the decay rates of solutions are expected to be the same as the corresponding parabolic problem. In this paper we obtain two kinds of decay rates of the solution effective for  $\rho > \rho_c(N, \alpha) = 1 + 2/(N - \alpha)$  and for  $\rho < \rho_c(N, \alpha)$ . We believe that in the “supercritical” exponent the decay rates obtained are almost the same as those for the linear parabolic problem, while, in the “subcritical” exponent the solution decays faster than that of linear equation, thanks to the absorbed semilinear term. So we believe that  $\rho_c(N, \alpha)$  is a

critical exponent. Note that  $\rho_c(N, \alpha)$  with  $\alpha = 0$  coincides to the Fujita exponent

$$\rho_F(N) := 1 + \frac{2}{N}.$$

Keywords:

Absorbed semilinear term

Damped wave equation

Space dependent potential

Mathematics Subject Classification:

35L05

35L70

37L15

## Acknowledgments

The author would like to thank Professor Grozdna Todorova so much for her comments and advice on the original version of this manuscript. This work was supported in part by Grant-in-Aid for Scientific Research (C) 20540219 of Japan Society for the Promotion of Science.

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