The external damping problems with general powers of the Laplacian

Pham Trieu Duong
Hanoi National Univesrsity of Education, Hanoi, Vietnam
email: duongptmath@hnue.edu.vn

Abstract We present in this talk the survey on the following external damping problem

$$\begin{aligned} u_{tt} + (-\Delta)^{\sigma} u + u_t &= ||D|^a u|^p \\ u(0,x) &= u_0(x) \\ u_t(0,x) &= u_1(x) \end{aligned}$$

with the assumption on the powers: $0 < a < \sigma,\ p > 1$, as previously, but the parameter σ belongs new range $\sigma \in (1, \infty)$. In the literatures that are devoted to the similar model with diffusion properties, the range $0 < \sigma < 1$ is stated frequently as a default, since only inside this restricted range, the operator $(-\Delta)^{\sigma}$ is *stable*. However other extended values of parameter σ occur too in the real-world problems and it gives the interests in study. We present our method of research instead of applying the statistics and probability notions, as it was proved successfully for the classical case $\sigma \in (0, 1)$. Our results indicate besides which essential conditions for differential operators that would influence on the decay estimates and the solvability as well for these initial value problems.

Bibliography

[1] D'Abbicco, M. and Reissig, M., *Semi-linear structural damped waves*, Mathematical Methods in the Applied Sciences **37**, 1570-1592 (2014).

[2] Narazaki T. and Reissig M. L^1 *Estimates for oscillating integrals related to structural damped wave models*, in Studies in Phase Space Analysis with Applications to PDEs, Cicognani M, Colombini F, Del Santo D (eds), Progress in Nonlinear Differential Equations and Their Applications. Birkhauser, Springer: New York, Heidelberg, Dordrecht, London, ; 215258 (2013).

[3] Pham Trieu Duong, Kainane, M. and Reissig, M., *Global existence for semi-linear structurally damped σ-evolution models*, 29 A4, submitted.

[4] Radu P. , Todorova G. and Yordanov B., *Diffusion phenomenon in Hilbert spaces and applications*, J. Differential Equations **250**, 42004218 (2011) .

[5] Vazquez J.L., *Nonlinear diffusion with fractional Laplacian*, in "Nonlinear partial differential equations: the Abel Symposium 2010", Holden, Helge & Karlsen, Kenneth H. eds., Springer, 271-298 (2012).