Universidade Federal de Santa Catarina
Centro de Ciências Físicas e Matemáticas
Pós-Graduação em Matemática

Seminars on Differential Equations (2018.1)

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STRUCTURAL DAMPED $\sigma-$EVOLUTION EQUATION WITH FAST OSCILLATION I

Abstract

In this talk we present the structural damped $\sigma-$evolution equation:

$$u_{tt}(t,x) + A^{\sigma}u(t,x) + b(t)A^{\theta}u_t(t,x) = 0, \qquad (t,x) \in (0,\infty) \times \mathbf{R}^n \tag{1}$$

with initial data

$$u(0,x) = u_0(x), \quad u_t(0,x) = u_1(x) \qquad x \in \mathbf{R}^n, \tag{2}$$

where $A := -\Delta = -\sum_{i=1}^{n} \frac{\partial^2}{\partial x_i^2}$.

We assume that, for a sufficient large $t_0 > 0$, $b \sim g$ in $[t_0, \infty)$, that is, exists $a_1 > 0$ and $a_2 > 0$ such that $a_1 g(t) \leq b(t) \leq a_2 g(t)$ for all $t \geq t_0$, in which $g(t) = (1+t)^{\alpha} ln^{\gamma}(1+t)$.

In this work, we consider $\alpha \in [-1, 1)$ and we deal with the case $2\theta = \sigma(1+\alpha)$ with $\gamma \leq 0$ or $2\theta > \sigma(1+\alpha)$ with $\gamma \in \mathbb{R}$. The goal of the apresentation is to show decay estimates of solutions to problem (1)-(2).

The main difference from the previous works is that we don't require any control of $\frac{d}{dt}b$, see for example [2] and [3]. The results are consistent with the cited papers and, in particular, when $g = 1$ the results are also consistent with the estimates obtained in [1]. The remaining case, that is, $2\theta = \sigma(1+\alpha)$ with $\gamma > 0$ or $2\theta < \sigma(1+\alpha)$ with $\gamma \in \mathbb{R}$ will be presented in the future (hopefully).

Keywords and Phrases: $\sigma-$evolution; Fractional damping; Multiplier method.

References:
1. Charão, R. C.; da Luz, C. R.; Ikehata, R. *Sharp decay rates for wave equations with a fractional damping via new method in the Fourier space*, J. Math. Anal. Appl., 408 (2013), 247âĂŞ255.
2. D'Abbicco, M. Ebert, M. R. , *A classification of structural dissipations for evolution operators*, Math. Methods in the Appl. Sci., (2015). DOI: 10.1002/mma.3713.
3. Kainane, M. , *Structural damped $\sigma-$evolution operators.* PhD Thesis, TU Bergakademie Freiberg, Freiberg, 2014.

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Room 202 - Maths Department

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