$\sigma-$EVOLUTION MODELS WITH LOW REGULAR TIME DEPENDENT EFFECTIVE STRUCTURAL DAMPING

Abstract. In this talk, we disscus decay estimates for solutions to the $\sigma-$evolution model:

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

with suitable initial data

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

in which $A := -\Delta$, $\sigma > 0$, $\theta \in [0,\sigma]$ and with low regular b, that is, we don't assume any control of $\frac{d}{dt}b$, a relevant difference in comparison with other works, such [1].

In our previous work [2], we developed a new energy method to treat the problem (1)-(2) in the non-effective case. Originally, the idea was to separate $[t_0,\infty)\times\mathbb{R}^n$ in several zones, say Z, and for each of them find a suitable $K(t,\xi)$ such that

$$\int_S^T K(s,\xi)E(s)ds \leq CE(S), \tag{3}$$

for all (S,ξ) and (T,ξ) in Z. Here, E represents the density energy $E(t) = E(t,\xi)$ associated with (1) in Fourier space. The monotonicity of E and inequality (3), ensure decay rates for the problem (1)-(2). On the other hand, in the effective case a straightforward application of this method is possible, but is not enough to ensure the sharp decay rates already known for the case in which b is more regular [1]. To overcome this issue we try to replace the standard energy E in inequality (3) by a suitable function $F(t,\xi)$.

Roughly speaking, it seems that we will choose F as Lyapunov's functional for E. However, that is not exactly the point. Firstly, our $F(t,\xi)$ is not equivalent to $E(t,\xi)$. Secondly, we only have some control on $\frac{d}{dt}F(t)$, but no monotonicity for F is available. With F we obtain decay estimates for u, and using it further steps ensure decay estimates for u_t. We shall see that this construction is far from easy and several additional results, when compared to [2], are required to achieve the desired estimates in the effective case.

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