Regularity of the semigroup associated with some interacting elastic systems

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Abstract

In this talk, we examine regularity and stability issues for two damped abstract elastic systems. The damping involves the average velocity and a fractional power θ, with θ in $[-1,1]$, of the principal operator. The matrix operator defining the damping mechanism for the coupled system is degenerate. First, we prove that for θ in $(\frac{1}{2},1]$, the underlying semigroup is not analytic, but is differentiable for θ in $(0,1)$; this is in sharp contrast with known results for a single similarly damped elastic system, where the semigroup is analytic for θ in $[\frac{1}{2},1]$; this shows that the degeneracy dominates the dynamics of the interacting systems, preventing analyticity in that range. Next, we show that for θ in $(0,\frac{1}{2}]$, the semigroup is of certain Gevrey classes. Finally, we show that the semigroup decays exponentially for θ in $[0,1]$, and polynomially for θ in $[-1,0)$. To prove our results, we use the frequency domain method, which relies on resolvent estimates. Optimality of our resolvent estimates is also established. Two examples of application are provided. This is a joint work with F. Shel and L. Tebou