Regularity Analysis for an Abstract System of Coupled Hyperbolic and Parabolic Equations with Inertia Term

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Abstract

In this presentation, we provide a complete regularity analysis for the following abstract system of coupled hyperbolic and parabolic equations

$$\begin{cases} u_{tt} + A^{\gamma} u_{tt} = -Au + cA^{\alpha}\theta, \\ \theta_t = -cA^{\alpha} u_t - kA^{\beta}\theta, \\ u(0) = u_0, \quad u_t(0) = v_0, \quad \theta(0) = \theta_0, \end{cases} \tag{1}$$

where A is a self-adjoint, positive definite operator on a complex Hilbert space H, and $(\alpha, \beta, \gamma) \in S = [0, \frac{\beta+1}{2}] \times [0,1] \times [0,1]$. We are able to decompose the region S into three parts where the semigroup associated with the system is analytic, of specific order *Gevrey* classes, and non-smoothing, respectively. Moreover, by a detailed spectral analysis, we will show that the orders of *Gevrey* class is sharp, under proper conditions. Furthermore, we also show that the orders of polynomial stability obtained in an earlier paper by Fernández Sare, Liu, and Racke are optimal.

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