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Nonuniform Stability Properties of Coupled Systems

Recent research has demonstrated that polynomial and nonuniform stability of semigroups appear frequently in the study of coupled systems of linear partial differential equations. This is especially the case when PDEs of mixed types are coupled through a shared boundary [3] or inside a common spatial domain [1].

In this presentation we consider a selection of such PDE systems and discuss how many of them can be viewed as particular cases of composite systems consisting of an unstable and a stable abstract linear differential equation. As our main results we present new general conditions for proving the polynomial or nonuniform stability of coupled PDE systems in this abstract setting [2]. The results are motivated by and primarily applicable for coupled PDEs on one-dimensional or geometrically simple spatial domains. We also discuss the degrees of stability given by the abstract results compared to those obtained by direct approaches.

References

- [1] E. M. Ait Ben Hassi, K. Ammari, S. Boulite, and L. Maniar, *Stability of abstract thermo-elastic semigroups*, J. Math. Anal. Appl. **435** (2016), no. 2, 1021–1035.
- [2] Lassi Paunonen, *Stability and Robust Regulation of Passive Linear Systems*, ArXiv e-prints (<https://arxiv.org/abs/1706.03224>) (2017).
- [3] Xu Zhang and Enrique Zuazua, *Long-time behavior of a coupled heat-wave system arising in fluid-structure interaction*, Arch. Ration. Mech. Anal. **184** (2007), no. 1, 49–120.