Long-time behavior of partially damped systems modeling degenerate plates with piers

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Abstract

We consider a partially damped nonlinear beam-wave system of evolution PDE's modeling the dynamics of a degenerate plate. The plate can move both vertically and torsionally and, consequently, the solution has two components. We show that the component from the damped beam equation always vanishes asymptotically while the component from the (undamped) wave equation does not. In case of small energies we show that the first component vanishes at exponential rate. Our results highlight that partial damping is not enough to steer the whole solution to rest and that the partially damped system can be less stable than the undamped system. Hence, the model and the behavior of the solution enter in the framework of the so-called *indirect damping* [9] and *destabilization paradox* [2,3,8,10]. These phenomena are valorized by a physical interpretation leading to possible new explanations of the Tacoma Narrows Bridge collapse [1,7] and to possible damages due to the damping control parameter. This is joint work with A. Soufyane (Sharjah, UAE), based on a previous model developed in [4,5,6] with M. Garrione (Milano, Italy).

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