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Title: Interplay of Coupling and Kelvin–Voigt Damping in Wave–Plate Dynamics.

Abstract: We investigate the long-time dynamics of coupled wave–structure systems, including wave–Euler–Bernoulli beams and multidimensional wave–plate equations, under localized Kelvin–Voigt damping. Strong stability of the associated C_0 -semigroup is established via the Arendt–Batty criterion combined with unique continuation arguments, while exponential stability is excluded by spectral analysis. Polynomial decay is then quantified using a frequency-domain approach with piecewise multipliers.

In the multidimensional case, decay rates explicitly depend on damping effectiveness:

$$t^{-1/(\max\{\alpha,\beta\}+2)} \quad \text{when both dampings act,}$$

and slower rates

$$t^{-1/(2\max\{\alpha,\beta\}+2)} \quad \text{or} \quad t^{-1/(2\max\{\alpha,\beta\}+4)}$$

when only one damping mechanism is active. These results highlight how coupling and damping localization govern energy dissipation in wave–plate systems.