Akram Ben Aissa (University of Monastir)

Title: Energy Decay in Coupled Wave-Structure Systems with Localized Kelvin-Voigt Damping.

Abstract: We study the long-time behavior of coupled wave-structure systems, including wave-Euler-Bernoulli beam models and multidimensional wave-plate equations, in the presence of localized Kelvin–Voigt damping. The analysis is carried out at the semigroup level, where strong stability of the associated C_0-semigroup is established via the Arendt–Batty criterion combined with unique continuation arguments. Spectral analysis further shows that exponential stability does not hold.

We then derive polynomial energy decay rates using a frequency-domain approach based on piecewise multiplier techniques. In the multidimensional setting, the decay rate is shown to depend explicitly on the effectiveness of the damping mechanism. When both damping terms are active, the decay rate is given by

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

while in the presence of partial damping, slower decay rates are obtained:

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

These results highlight the precise role of coupling and localized damping in governing the dissipation mechanisms of wave–plate systems.