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On the Strictly Uniform Exponential Decay of a Mixed-FEM Discretization for the Wave Equation with Boundary Dissipation

Many approximation methods, such as standard finite elements, fail to preserve the decay rate of dissipative wave problems. Strictly preservation of the exponential stability by a first-order mixed finite element approximation method is shown for the one-dimensional wave equation with a partially reflective boundary. We use the multiplier method to analyze the continuous system's exponential stability, expressing the exponential decay rate and amplitude as functions of the physical parameters and boundary dissipation gain. An equivalent analysis is applied to prove that the energy of the approximated model is exponentially stable, and also to provide a similar bound in terms of the physical parameters.