SPECTRUM ANALYSIS OF THE WEIGHTED FINITE DIFFERENCE SCHEME FOR THE WAVE EQUATION WITH INTEGRAL BOUNDARY CONDITIONS∗

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Consider the hyperbolic equation

\[ \frac{\partial^2 u}{\partial t^2} - c^2 \frac{\partial^2 u}{\partial x^2} = f(x, t), \quad (x, t) \in (0, L) \times (0, T), \]

with the classical initial conditions

\[ u|_{t=0} = \phi(x), \quad \left. \frac{\partial u}{\partial t} \right|_{t=0} = \psi(x), \quad x \in \Omega := [0, L], \]

and the additional nonlocal integral boundary conditions

\[ u(0, t) = \gamma_0 \int_0^L \beta^0(x) u(x, t) \, dx + v_l(t), \quad t \in [0, T], \]

\[ u(1, t) = \gamma_1 \int_0^L \beta^1(x) u(x, t) \, dx + v_r(t), \quad t \in [0, T], \]

where \( f(x, t), \phi(x), \psi(x), v_l(t), v_r(t) \) are given functions, \( \gamma_0, \gamma_1 \) are given parameters, \( \beta^0 \) and \( \beta^1 \) are weight functions.

We study the spectrum of the weighted difference operator for the formulated problem using the methods described in [1]. We investigate the characteristic function [2], and obtain stability conditions subject to boundary variables \( \gamma_1, \gamma_2 \) and weight functions.

REFERENCES


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