Modified Numerical Technique for the Solution of the Telegraph Equation

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Abstract:

The telegraph equation describes the voltage and current on an electrical transmission line with distance and time.

$$\frac{d^2u}{dx^2} = \alpha \frac{d^2u}{dt^2} + \beta \frac{du}{dt} + \Upsilon u$$

with the initial conditions: $u(x,0) = \phi_1(x)\,, \quad u_t(x,0) = \phi_2(x)$

and the boundary conditions $u(0,t) = \psi_1(t)\ , \quad u_x(0,t) = \psi_2(t)$

where $\boldsymbol{\alpha}$, $\boldsymbol{\beta}$ and $\boldsymbol{\Upsilon}$ are positive constants and $\phi_1(x), \phi_2(x), \psi_1(t), \text{and } \psi_2(t)$ are continuous functions.

In this paper, we introduce a numerical solution for the one-dimensional telegraph equation based on the finite difference scheme. The numerical results show the applicability, efficiency, and accuracy of the method compared with other methods.

Keywords:

Parallel Computing/Numerical Analysis, Mathematical Modeling, Operations Research.