CEE 6513 Computational Methods in Mechanics
Fall 2023 Georgia Tech
Homework 5. Due: Nov 06, 2023 (Canvas)

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1 Problem (30 points)

The displacement field $u(x,t)$ of a propagating wave in one dimension is governed by the equation:

$$u_{tt} = u_{xx}\,. \tag{1}$$

Consider a bar of length $L = 1$ which is initially at rest:

$$u(x,t) = 0, \quad t \leq 0\,, \quad 0 \leq x \leq L\,. \tag{2}$$

The bar is excited at its left end, i.e., someone starts to move the left end of the bar according to:

$$u(0,t) = f(t) = \begin{cases} 1-\cos(2t) & 0 \leq t \leq \pi \\ 0 & \text{otherwise}\,. \end{cases} \tag{3}$$

The right end of the bar is pinned, i.e.,

$$u(L,t) = 0\,, \tag{4}$$

so that incoming waves will be reflected. Use an explicit finite-difference scheme to solve this problem and plot the solution at $t = 20, 40, 60, 80, 100$.