Math 331 Matlab Project

Consider the 1-D wave equation:

$$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}, \quad 0 < x < L, \quad t > 0 \tag{1}$$

with boundary conditions:

$$u(0,t) = u(L,t) = 0, \quad t > 0 \tag{2}$$

and initial conditions:

$$u(x,0) = f(x), \quad \frac{\partial u}{\partial t}(x,0) = 0, \quad 0 < x < L \tag{3}$$

Write a matlab code to visualize the solutions of the following cases:

- Let $c = 1$ and $L = 1$ and

$$f(x) = \begin{cases} 2x/L & \text{when } 0 < x < L/2 \\ 2(L-x)/L & \text{when } L/2 < x < L \end{cases}$$

- Let $c = 1/\pi$ and $L = 1$ and

$$f(x) = \begin{cases} 3x/10L & \text{when } 0 < x < L/3 \\ 3(L-x)/20L & \text{when } L/3 < x < L \end{cases}$$

- Let $c = 2$ and $L = \pi$ and

$$f(x) = \pi^2 x - x^3$$

- Let $c = 1$ and $L = 1$ and

$$f(x) = \begin{cases} x - 3/8 & \text{when } 3/8 \le x \le 1/2 \\ 5/8 - x & \text{when } 1/2 \le x \le 5/8 \\ 0 & \text{otherwise} \end{cases}$$

For each set, vary the number of terms and see what happens to the solution.