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METHOD OF LINES

Solve the initial value problem for the 1D wave equation

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

$$u(x, 0) = e^{-\frac{x^2}{\sigma}}, \quad \sigma = 0.01$$

$$\frac{\partial}{\partial t} u(x, 0) = 0$$

for the varying propagation speed

$$c^2(x) = \begin{cases} 2.0 & , x \in [-L, 0.5L] \\ 0.5 & , x \in [0.5L, L] \end{cases}$$

by the method of lines.

Use the following discretization parameters $L = 1$, line spacing $h = 0.01$