4.8. Finite difference methods

The goal of this homework is to properly modify the MATLAB programs available in the file PDESolver.zip to solve the heat equation and wave equation on the line under the scenario that the boundary conditions are nontrivial. For this homework you need to hand in a paper copy of Heat1D.m, HeatVF.m, Wave1D.m, and WaveVF.m with your changes from the original highlighted. In addition, hand in a paper copy of your solution plot for each problem.

4.8.6. Consider the heat equation

\[ u_t = u_{xx}, \quad u(x,0) = \frac{\pi}{2} - |\frac{\pi}{2} - x| \]
\[ u(0,t) = 1 - \cos(2t) \]
\[ u(\pi,t) = \sin(t). \]

Solve the equation for \(0 \leq t \leq 30\), and plot the solution. In order that you do not store too much information, set \(T_{collect} = .05\).

4.8.7. Consider the wave equation

\[ u_{tt} = u_{xx}, \quad u(x,0) = u_t(x,0) = 0 \]
\[ u(0,t) = \sin(t/2) \]
\[ u(\pi,t) = 1 - \cos(3t/2). \]

Solve the equation for \(0 \leq t \leq 30\), and plot the solution. In order that you do not store too much information, set \(T_{collect} = .05\).

4.8.8. Consider the wave equation

\[ u_{tt} = u_{xx}, \quad u(x,0) = u_t(x,0) = 0 \]
\[ u_x(0,t) = \sin(t/2) \]
\[ u_x(\pi,t) = 1 - \cos(3t/2). \]

Solve the equation for \(0 \leq t \leq 30\), and plot the solution. In order that you do not store too much information, set \(T_{collect} = .05\).