

Math 333 Homework Problems #2

APPLIED PARTIAL DIFFERENTIAL EQUATIONS (2ND EDITION), by J.D. Logan

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

$$\begin{aligned}u_t &= u_{xx}, & u(x, 0) &= \pi/2 - |\pi/2 - x| \\u(0, t) &= 1 - \cos(2t) \\u(\pi, t) &= \sin(t).\end{aligned}$$

Solve the equation for $0 \leq t \leq 30$, and plot the solution. In order that you do not store too much information, set `Tcollect = .05`.

4.8.7. Consider the wave equation

$$\begin{aligned}u_{tt} &= u_{xx}, & u(x, 0) &= u_t(x, 0) = 0 \\u(0, t) &= \sin(t/2) \\u(\pi, t) &= 1 - \cos(3t/2).\end{aligned}$$

Solve the equation for $0 \leq t \leq 30$, and plot the solution. In order that you do not store too much information, set `Tcollect = .05`.

4.8.8. Consider the wave equation

$$\begin{aligned}u_{tt} &= u_{xx}, & u(x, 0) &= u_t(x, 0) = 0 \\u_x(0, t) &= \sin(t/2) \\u_x(\pi, t) &= 1 - \cos(3t/2).\end{aligned}$$

Solve the equation for $0 \leq t \leq 30$, and plot the solution. In order that you do not store too much information, set `Tcollect = .05`.