Math 333 Homework Problems #7

APPLIED PARTIAL DIFFERENTIAL EQUATIONS ... (4TH EDITION), by R. Haberman

6. FINITE DIFFERENCE NUMERICAL METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS

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 `HeatFiniteDifferenceStudentVersion.m`, `HeatVF.m`, `WaveFiniteDifferenceStudentVersion.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.

6.1. Consider the heat equation

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

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

6.2. Consider the wave equation

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

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

Extra Credit. Consider the heat equation

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

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