AMSC/CMSC 460 Dr. Wolfe ASSIGNMENT #6 Due July 22, 2004

1. Write a function m-file **myrk.m** along the lines of the m-file **myeuler.m** which I have posted. It should implement the classical fourth order Runge-Kutta method with y and f vectors. Try your code with various step sizes on the example

$$y'' + y' - 6y = 20e^t, \quad y(0) = 0, \quad y'(0) = 1, \quad 0 \le t \le 2$$

whose exact solution is $y(t) = -5e^t + .8e^{-3t} + 4.2e^{2t}$.

2. We again consider the nonlinear two-point boundary value problem

$$y'' = e^y - 1, \quad y(0) = 0, \quad y(1) = 3$$

We are going to find the missing initial value $y'(0)$ by using the *shooting method.* We denote the solution of

$$y'' = e^y - 1, \quad y(0) = 0, \quad y'(0) = s$$

by $y(t; s)$. The problem is to find s so that $y(1; s) = 3$. For each value of s, we can use **ode45** to find $y(1, s)$. We then use **fzero** to find the root of $G(s) = y(1; s) - 3 = 0$. (You should compare your answer with the answer to Assignment#5, problem 8.) Once you have found $y'(0)$, use **ode45** to plot the solution.

3. Ex. 7.4 p.35 *Numerical Computing with MATLAB.*

4. Ex. 7.12 p.38 *Numerical Computing with MATLAB.*

5. Ex. 7.14 p.39 *Numerical Computing with MATLAB.*