CSC2322H

Assignment 2

October 18, 2011 University of Toronto **Due:** November 8, 2011

Using a multiple shooting code which will be provided (MUSN, described in Appendix A of the text), you are to investigate the solution of three test problems, each of which depends on a scalar parameter. In each case, three values of the parameter are specified to be the values of interest, and you are to attempt to produce approximate solutions for each value of interest. Two of these test problems are based on problems discussed in section 1.2 of the text.

For each problem, the specified values of the parameter correspond to increasing levels of difficulty. You will likely have to use continuation to solve these problems (for some of the specified values) and, even with continuation, you may not be able to produce solutions for all parameter values of interest. In your write-up discuss whether continuation was necessary and how difficult it was to obtain an accurate approximate solution. The three test problems are:

1. The solution has a boundary layer at $x = 0$.

$$\epsilon y'' = y - yy', \;\; y(0) = 1, \; y(1) = \frac{3}{2}.$$

$$\epsilon = (0.1, \; 0.03, \; 0.001).$$

2. This equation models nonlinear elastic beams.

$$y' = sin(\theta), \theta' = M, \epsilon M' = -Q, \epsilon Q' = (y-1)cos\theta - MT,$$

with

$$T = sec\,\theta + \epsilon Q tan\theta, \text{ and } y(0) = y(1) = 0, \; M(0) = M(1) = 0.$$

$$\epsilon = (0.1, \; 0.05, \; 0.01).$$

3. This problem arises in the modelling of fluid flow in a long vertical channel.

$$y'''' = R(y'y'' \; - \; yy'''), \; y(0) = y'(0) = 0, \;\; y(1) = 1, y'(1) = 0.$$

$$R = (100, \; 500, \; 10000).$$