Numerical Methods II

Lab Session 4

March 8, 2004

1. "Harden" your favorite adaptive time-stepping scheme (e.g. the embedded Runge–Kutta Prince–Dormand 4,5 pair from Lab 1) by making sure the code exits gracefully when the maximum number of steps is reached, or when the time step is getting too small.

2. Implement the Van Wijngaarden–Dekker–Brent root finding method from the *Numerical Recipes*,

   http://www.library.cornell.edu/nr/bookcpdf/c9-3.pdf

   in Octave.

3. Use the ODE solver from Task 1 in combination with the Van Wijngaarden–Dekker–Brent method to solve the boundary value problem

$$y''(t) = 5\,\sinh(5\,y(t))\,,$$
$$y(0) = 0\,,$$
$$y(1) = 1$$

   by simple shooting. If the ODE solver terminates prematurely, take the last value computed as the value at the final time $t = 1$.

   Note: You may start with using the bisection method for verification of the shooting code before implementing the Van Wijngaarden–Dekker–Brent root finding method.