COMP 6361 Numerical Analysis of Nonlinear Equations

Assignment 3 Due March 10

Apply the Runge-Kutta method from Page 353 of the Background Notes to the initial value problem that describes a chemical reaction on Page 12 of the Lecture Notes. Do this for two distinct values of the parameter β, and for a suitable range of values of the parameter D.

The values of β should be chosen from those used in the bifurcation diagrams on Pages 13, 26, and 28, with D in the range of values shown there. Relate the results of your numerical simulations to what is shown in the diagrams. Particular attention should be given to values of D where a change in dynamical behavior occurs, namely at folds, homoclinic orbits, and Hopf bifurcations.

Try to reconstruct the bifurcation diagrams using your initial value solver, by integrating for a sufficiently long time. Note that only stable solutions in the bifurcation diagrams can be found this way. Briefly discuss the length of the integration time that is needed to find the stable solutions represented in the bifurcation diagrams.

Also apply your initial value solver to the predator-prey model on Pages 29-38 of the Lecture Notes, and relate the results to the bifurcation diagram on Page 33 and 36.