UBMTP - XPP Assignment
February 2, 2005

The main goal of this project is to learn how to use XPP. XPP is an ODE solver and has an interface to a bifurcation continuation program called AUTO. XPP is available on afs. Documentation and a manual for its usage is available at the website of Bard Ermentrout (http://www.pitt.edu/ phase/).

1. Consider the differential equation:

$$x' = \mu x - x^3.$$

   Use XPP and its interface to AUTO to draw the bifurcation diagram for this equation.

2. Consider the equation

$$v' = f(v) - w + I_{app} \quad (1)$$
$$w' = \epsilon(v - \gamma w) \quad (2)$$

   $f(v) = v(1-v)(v-a)$ where $a = 0.25$, $\epsilon = 0.1$, $\gamma = 1$. Try to understand how the solution depends on I_{app}. What values of I_{app} yield periodic solutions versus stable critical point solutions? How does the frequency of the periodic solutions depend on I_{app}.

3. Replace the w' equation above by:

$$w' = \epsilon(w_\infty - w) \quad (3)$$

   where $w_\infty = 0.5(1 + \tanh[(v-b)/k]$, $b = .7$, $k = .15$. Answer the same questions as the previous problem.

4. As an extra challenge, try to create bifurcation diagrams using AUTO for the equations in problems 2 and 3.