Fall 2015 * Math 430 * Math 635 * Prof. Victor Matveev
Homework 9 * Due date: November 12

1. Use your homework #8 Morris-Lecar model code with parameter values corresponding to the Homoclinic Orbit Bifurcation to find a value of I giving bistable behavior. For this value of I, find two distinct initial conditions, so that the first initial condition results in return to rest, while the second initial condition leads to periodic spiking. You may want to look at the posted figures explaining the Homoclinic Orbit bifurcation to guide you.

2. Write a program for the Hodgkin-Huxley model (use the parameters in the hand-out), and pick any *V*(0) above the threshold (assume *n*(0)=*m*(0)=0, *h*(0)=1), obtaining a single spike. Then, within the same figure, make the following panels using command "subplot":

   - Plot of *V*(*t*) as a function of time, showing a single spike
   - Plot of $n(t)$, $m(t)$ and $h(t)$ as functions of time
   - Plot of $I_{Na}(t) = g_{Na}\, m^3(t)\, h(t)\,(V(t) - V_{Ca})$ and $I_K(t) = g_K n^4(t)(V(t) - V_K)$ as functions of time

   You can use any subplot layout that you like. Note: do not examine the model phase space, since it is 4-dimensional!

3. Plot equilibrium I-V curves for I_{Na} and I_K in the Hodgkin-Huxley model. Does I_{Na} have a non-negligible window current?

4. Find the critical value of applied current I for which the Hodgkin-Huxley model transitions to periodic spiking. Does Hodgkin-Huxley model have Class 1 or Class 2 excitability?