PHY 250L – Spring 2018
Computing tutorial 8

Welcome back to the PHY 250L computing tutorial, PHASE 3 MATLAB wooooooo! This week, you'll deploy some general skills to "solve" differential equations numerically. You'll use MATLAB for this, but it's important to remember that this is a *general* skill.

Please consult the notes from class (see Sakai).

Problems for 4.26.2018 The following problems should be completed (in MATLAB, duh) and uploaded to Sakai by 09:45 on 4.26.2018. Each problem should correspond to its own MATLAB program (*i.e.*, each problem will correspond to a single file). The preferred names for the files are indicated in each problem.

1. `foode.m`, 20 points
   Write a program that plots $y(t)$ that solves the following F-O ODE:

$$y' = -2t^2 y + y^2 - 2y\cos(4t) \tag{1}$$

   with $y(0) = 1$. Plot $y(t)$ for $t \in [0, 4]$.

2. `oscillator.m`, 30 points
   Recall that the DE that describes a damped oscillator is

$$my'' + by' + ky = 0 \tag{2}$$

   Write a program that simulates the motion of a damped oscillator with $m = 1$ and $k = 20$, and 11 values of b between 20% and 120% of the critical value, b_c. Your program should plot $y(t)$ vs t for all of the b values on the same set of axes for $t \in [0, 12]$. Use the initial conditions $y(0) = 0.2$ and $y'(0) = 0$.

3. `driven_oscillator.m`, 30 points
   Now simulate the motion of an oscillator, but with the addition of a driving force:

$$my'' + by' + ky = 0.2\cos(\omega t) \tag{3}$$

   Use $m = 1$, $k = 20$, and $b = b_c/4$. Use 11 values of ω between 60% and 140% of the critical value. Your program should plot $y(t)$ vs t for all of the ω values on the same set of axes for $t \in [0, 20]$