ENGR232 Week 5 Lab
Summer 2016-17

Create a published document with your name and section number and version of the lab assignment. Answer each part in a separate cell – include discussion, plots and code where appropriate.

Given the initial value problem: $\boldsymbol{y'' + 6y' + 9y = 0 \quad y(0) = -2 \quad y'(0) = 3}$

a) Determine the auxiliary equation and find the roots. Based on the roots what type of solution do you expect (stable or unstable, shape etc.)?

b) Write the equations in state space (matrix form) $x'(t) = Ax(t) + Bf(t)$. Let x_1 = y and x_2 = y'.

c) Determine the critical/equilibrium point. Show how you got your answer.

d) Numerically solve the IVP using ode45. Plot the two states for the time interval [0, 4] in the left two panes and the phase plot x_2 vs x_1 in the right 2 panes. Annotate all plots. Use legend to annotate the initial conations and equilibrium point on the phase plot. Call this solution the **numeric solution**.

e) Use dsolve to find the solution of the IVP and also find its derivative. Use the matlabFunction() to create a function for y and y'. You need to submit a time vector to function created by matlabFunction(). Call this solution the **analytic solution**.

f) Create one graph with three sub plots.
   a. For subplot 1 overlay the component plot for analytic solution of y from part e on the same plot as the numeric solution of y of part d. Are they the same?
   b. For subplot 2 overlay the component plot for analytic solution of y' from part e on the same plot as the numeric solution of y' of part d. Are they the same?
   c. For subplot 3 graph the phase plot.

Upload your published pdf file at the end of the class.