ECE 667 Homework 1
Due Thursday September 12, 2019

1. Write and use a computer program utilizing the Implicit Trapezoidal method to solve the below initial value problem. You may write this program in the language of your choice, including packages that have built-in capability for integrating differential equations (such as Matlab or Mathematica). However, if you use such a package you may not use this built-in capability; you must manually code the integration method. Turn in a listing of your program. Use an initial value $x_1=x_2=1$. Pick a reasonable Δt and a reasonable ending time. Justify your choice of both. Also give two equilibrium points.

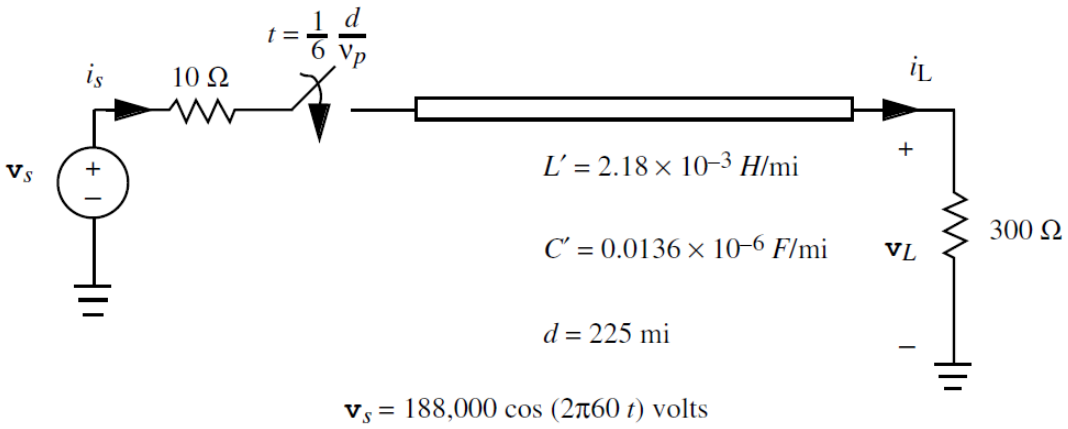
$$\dot{x}_1 = \frac{2}{3}x_1 - \frac{4}{3}x_1x_2$$
$$\dot{x}_2 = x_1x_2 - x_2$$

2. Write and use a computer program utilizing the Second Order Runge-Kutta method to solve the below initial value problem. The approach is the same as Problem 1. Use an initial value $x_1=x_2=x_3 = 5$. Pick a reasonable Δt. What is an equilibrium point? Describe the system behavior, including whether it converges to the equilibrium point.

$$\dot{x}_1 = 10\left(x_2 - x_1\right)$$
$$\dot{x}_2 = x_1(28 - x_3) - x_2$$
$$\dot{x}_3 = x_1x_2 - \frac{8}{3}x_3$$

3. Book 2.3 (see below) except change the left resistance to 5 Ω.

2.3 Given the sinusoidal source and de-energized lossless transmission line shown: draw the "Bergeron" algebraic "dc" circuit and find v_L, i_L, i_s



for $0 \leq t \leq 0.04$ sec using a time step of $\Delta t = \frac{1}{6}\frac{d}{\nu_p}$. Plot v_L.