

EE513 Homework 2

Due March 28th, 2016 @ class

Read Erickson textbook, Chapter 3&4.

Do Erickson textbook, problems 3.7, 3.10, 4.2, 4.7.

Transients and simulation Shown in Fig. 1 is a diagram of a circuit used to generate a large pulsed magnetic field. The capacitor is pre-charged to a voltage V_x , which can be between 0 and 1000 V. At time $t = 0$, the switch S is closed to trigger the magnetic pulse. The value of R is $85m\Omega$, C is $180\mu F$, and L is $13\mu H$. The switch S and diode D are ideal.

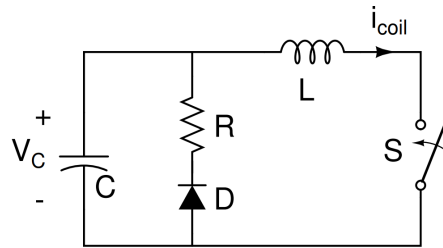


Figure 1:

Calculate the following:

1. The time response of the coil current (i_{coil}) after the switch S is closed, as a function of the pre-charge voltage V_x .
2. The peak coil current for $V_x = 1000V$
3. The time t_1 at which diode D turns on.
4. The energy dissipated in the resistor R for $V_x = 1000V$.
5. Simulate the circuit operation in Simulink. Plot the corresponding inductor current and capacitor voltages versus time.
6. Increase the resistor R until you observe an underdamped response of the system. Turn in a plot of the inductor current and capacitor voltage.

In the Simulink simulation, use "Simscape-SimPowerSystem-Specialized Technology" library to build this circuit.