

# EE270 Homework 2

Due March 14th, 2017 @ 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.

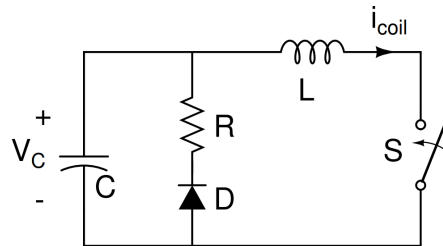


Figure 1:

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  $V_x = 100V$ .
5. Simulate the circuit operation in Simulink. Plot the corresponding inductor current and capacitor voltages versus time. Attach a print-out of these two state variables to your problem set.
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.