ECE 525: Homework #3

Due Session 15 (Oct 9)

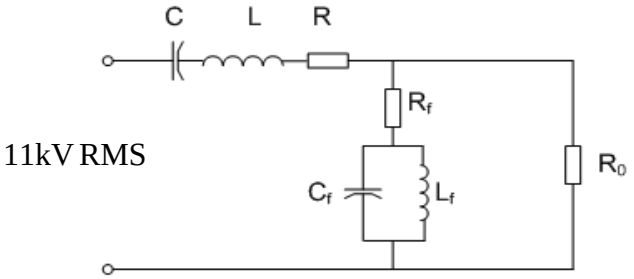
1. For the capacitively coupled voltage transformer (CCVT, also known as a capacitive voltage transformer or CVT) circuit below do the following:

A. Determine a Laplace domain transfer function for the relay voltage (the voltage across the load resistance R0) in response to a change in the input voltage. You might find the references linked with the CCVT lectures on the web page very useful.

B. Plot the frequency response of the magnitude of the output voltage from 20Hz to 25th harmonic of 60Hz.

C. Plot the responses for the output voltage versus time for the two sets of CCVT parameters listed below using a circuit simulation program when the primary voltage goes to zero due a fault occuring at a voltage peak with an ideal source. Determine analytical result for extra credit. You are encouraged to use a transient circuit simulation tool

D. Plot the responses for the output voltage versus time for the two sets of CCVT parameters listed below using a circuit simulation program when the primary voltage goes to zero due a fault occuring at at a voltage zero (again, ideal source). Determine analytical result for extra credit.



CCVT 1 (medium C (energy) CCVT)

$R_0 = 1.03997 \cdot 10^5$	— load resistance, Ω
$L_f = 315.3$	— suppression inductance, H
$C_f = 0.0285 \cdot 10^{-6}$	— suppression capacitance, F
$R_f = 77379$	— suppression resistance, Ω
$R = 3289$	— resistance, Ω
$C = 9.1605 \cdot 10^{-8}$	— sum of dividing capacitances, F
$L = 76.136$	— inductance, H

CCVT 2 (high C (energy) CCVT)

$R_0 = 2.08584 \cdot 10^5$	— load resistance, Ω
$L_f = 616.35$	— suppression inductance, H
$C_f = 0.01134 \cdot 10^{-6}$	— suppression capacitance, F
$R_f = 148519$	— suppression resistance, Ω
$R = 1536$	— resistance, Ω
$C = 0.162442 \cdot 10^{-6}$	— sum of dividing capacitances, F
$L = 48.136$	— inductance, H