UNIVERSITY OF CALIFORNIA
College of Engineering
Department of Electrical Engineering
and Computer Scences

EEECS100/42, Fall 2009 **T. K. Gustafson**

Fall 2009
Due : Sept 23 at lecture

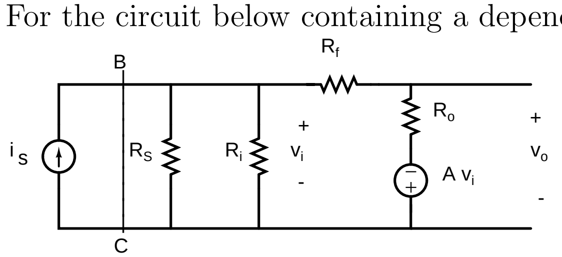
Problem Set No. 2

Based upon Chapter 2 of Hambley, the use of LTSpice and $r_c = 1/(pC)$, the resistance operator for the capacitor.

Problem Number one) The Wheatstone bridge- voltage division and Thevenin
Hambley Problem 2.102. For part a) the bridge is balanced ($i_s = 0$ and $v_a = v_b$ so use a voltage divider analysis). Use Thevenin for part b)

Problem Number two) Learning to use LTSpice- Transient analysis
Look at problem 4.3 of Hambley (Do not worry about having not read Chapters 3 and 4)
a) Using the fact that r_c for a capacitor is $1/pC$ deduce the differential equation for $v_c(t)$ with the driving term $v_s(t)$ on the right hand side of the equation. (Simply use the voltage divider for resistors with $r_c = 1/pC$ and clear the denomenators of p)
b) Using schematic capture of LTSPice draw the circuit. Use a capacitance value of 2pF and a resistance of 1 k Ω. For the voltage source specify a pulse with a value of 10V, a rise time and fall time of .1ns and a duration of 10 ns. Use a delay of 4 ns, a period of 100 ns and calculate for 1 period. Ask for a transient analysis over 100 ns with a maximum step size of 1ns. Have LTSpice Plot $v_c(t)$ for this simulation
c) Look at the Spice netlist and interpret each line.
d) Slide a book on a table or floor. Note the exponential velocity decay after it is released.

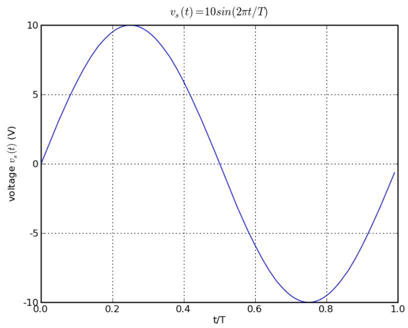
Problem No three) Dependent Sources
For the circuit below containing a dependent source:

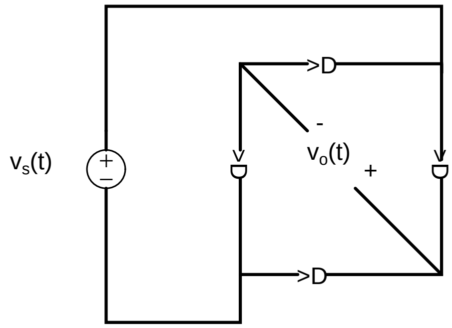


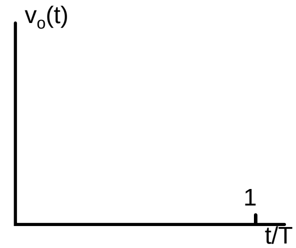
a) Determine the ratio of v_o/i_s, which we could refer to as a trans-resistance since it has units of Ohms.
b) Find the resistance seen looking into the terminals B-C
c) When the parameter A $-- > \infty$ what limiting values do parts a) and b) take?

Problem No four) Circuit Elements

A very useful element in electronics is a resistor that ideally has a value of zero for a plus voltage and in contrast an infinite resistance when it has a negative voltage applied. We will call this element $> D$ and assume the zero resistance occurs when $>$ is + with respect to D. We connect four of them in a bridge configuration as follows







a) for one cycle of a sinusoidal waveform applied $v_s(t) = 10sin(2\pi t/T)$ as shown, sketch the output voltage waveform v_o.

b) What is the average voltage at the input?

c) What is the average voltage at the output?

Problem No five) Mesh Analysis

problem 2.62 of Hambley

Problem No six) Superposition

problem 2.89 of Hambley