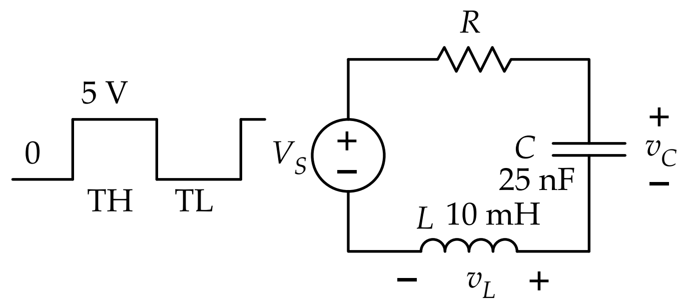
EE 201 — HW 7-15 Name____

In the *RLC* circuit shown at right, the source voltage pulses from 0 to 5 V and then back to 0 again, leading to transients in the circuit.



Find the value of R corresponding to critical damping (i.e. the boundary between over- and under-damped.)

A. Set R = 2.5 kΩ. Calculate the corresponding values of s_1 and s_2. Run a transient SPICE simulation that shows the capacitor and inductor voltages as functions of time when input steps from 0 to 5 V abruptly and then again when it steps back to 0 V.

B. Then set R = 500 Ω. Calculate s_1 and s_2 again and repeat the SPICE simulations for this case.

Comments:

You will need to run a transient simulation to see the voltage as a function of time. See the SPICE notes on how to do that.

You will want to use the VPULSE source, which allows you to set all the parameters for the source pulsing high and low. Note that the rise and fall times cannot be zero. To get around that limitation, just use very short times, like 1 ps.

You will need to adjust the high and low times to make sure that the transients die out nearly completely before the source transitions again. The values of s_1 and s_2 that you calculated can help you determine appropriate high and low times, but some trial-and-error might be needed. Makes the times "long enough", but not "too long".

Since there can be only one ground node, you will want to use the "differential" voltage probes to measure one or both of v_C and v_L.

Plot both the voltage waveforms on one set of axes for each of the two cases. In PSPICE, you might want to "invert" the printout, so that the graticule and traces are dark on a white background, as opposed to the screen display, which uses a black background. This saves ink and makes the plot much more legible.

Your homework submission should consist of 3 sheets — one with your calculations and an image of the circuit from SPICE and one for each of the transient graphs.

Write your answers — and whatever work will fit — on this sheet. Staple any sheets with additional work behind.