ECET 377
RLC Series Circuit Design Homework

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name

1. Draw the schematic of an RLC circuit whose output follows the general shape of the square wave input, but may have ringing, or a quick or slow exponential rise to the same level as the input.

2. Determine the transfer function of this circuit in terms of R, L, and C.

3. Write the *general* second order transfer function.

4. The 5% settling time is the time from when the input step occurs until the output *settles* to within 5% of its final level. Look at Figure 1.

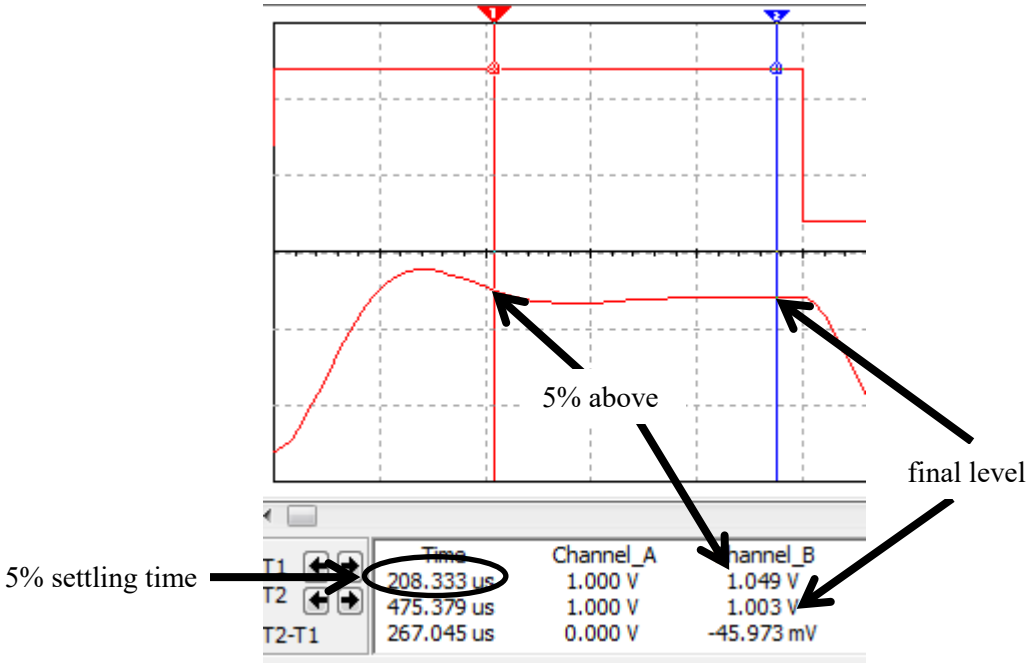
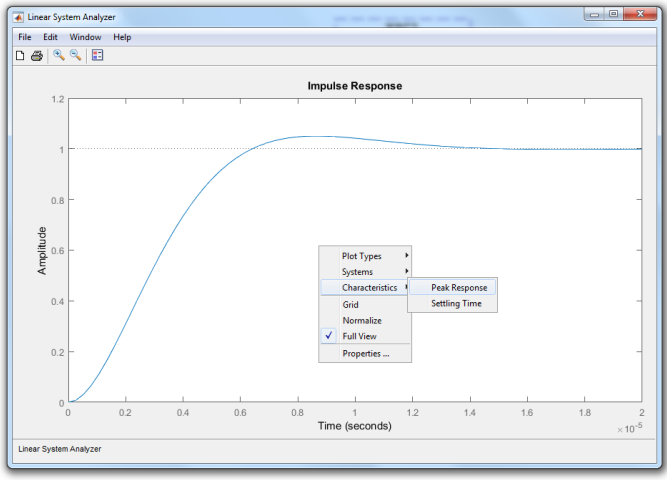
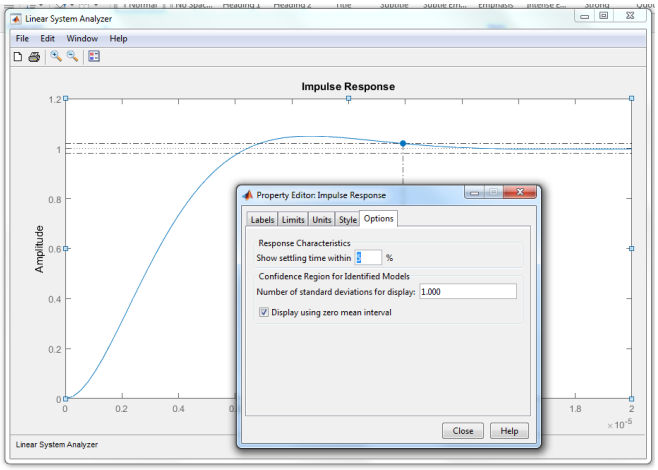


Figure 1 5% settling time measurement

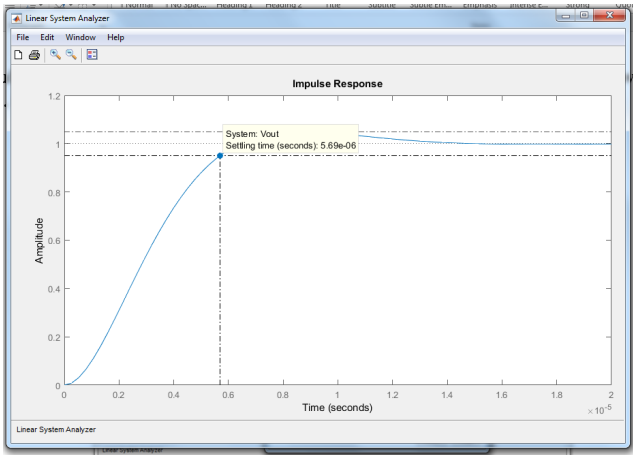
1) In **Matlab *ltiview***, right click on the plot and select: Characteristics > Settling Time



2) Double click on the graph. Go to: Options > Change "Show settling time within" to 5% > Close



3) Mouse over the point to see the settling time, or double click it to keep it on the screen to screenshot.



5. Using Multisim's Arbitrary Laplace Function with a 1 V square wave @ 1kHz, or Matlab's ltiview, $\xi = 0.99$, determine the response of your transfer for f_o = 5 kHz, then 20 kHz, then 80 kHz. Submit these three output plots. [Matlab produces a bad plot when $\xi = 1$, but is fine with 0.99, which is close enough.]

6. Which f_o produces the fastest setting time? (5kHz, 20kHz, 80kHz) _____

7. Using that f_o experimentally find the ξ that gives the fastest 5% settling time. Submit that transient response (or oscilloscope display), with cursors properly placed.

Settling time$_{Laplace}$ = _____ ξ= _____

8. Determine the values for R, L, and C to implement your design. Since you have three components to set two parameters, pick L = 33 mH or L = 450 μH. These are the two inductors you have. Show your work below. If your work produces unreasonably sized R or C, try the other inductor.

L = _____ R = _____ C = _____

9. Simulate your design using the closest standard values to the ones chosen in step 8. Use a 0 V to 1 V square wave input at 20 kHz. Capture and submit that schematic and transient analysis or oscilloscope display, with cursors properly placed.

5% settling time$_{RLC}$ = _____