University of California, Los Angeles

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Name: <>

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Experiment 4: Transient Response of the 2nd-Order Circuits

ECE11L Lab

Instructor: Sudhakar Pamarti

1. Series RLC Circuit Analysis

<Insert Waveforms Image showing the response across the capacitor.>
<Clearly zoom in for one period showing the transient response.>

- What is the inductor resistance?

$R_{inductor}$ =

- Derive theoretical equation for output voltage $v_o(t)$ (including R_L) across capacitor for your design.

Discussion

- What kind of damping is observed? Verify that this matches with the theoretical expectation.

<Answer in 2-3 lines. >

2. Underdamped RLC Circuit Design

<Insert Waveforms Image showing the response across the capacitor.>

<Clearly zoom in for one period showing the transient response. Overshoot must be seen clearly.>

Overshoot Measurement:

Experimental Value of Resistor used (Ω)	**Overshoot measured (%)**

Damped Frequency Measurement:

Experimental Damped Frequency (Hz)	**Theoretical Damped Frequency (Hz)**

- Derive theoretical equation for output voltage $v_o(t)$ (including R_L) across capacitor for new design.

Discussion

- How did the experimental damped frequency compare with the theoretical values?

<Answer in 2-3 lines. >

- What happens if you try to make the overshoot smaller?

<Answer in 1-2 lines.>

3. Critically Damped RLC Circuit

<Insert Waveforms Image showing the response across the capacitor.>

<Clearly zoom in for one period showing the transient response. Critical damping must be seen clearly.>

- What is the potentiometer resistance for critical damping?

$$R_{potentiometer} =$$

- Derive theoretical resistance needed for critical damping. (Include the effect of R_L)

Discussion

- How close was the value of resistance you ended up with when using the potentiometer to obtain a critically damped response, to the theoretical value you have derived? Consider the effects of inductor resistance as well.

<Answer in 1-3 lines. >

- What did you observe in the output waveform as resistance varied?

<Answer in 1-2 lines. >