

Name: _____ (please print)

Signature: _____

ECE 2202 – Quiz 6

November 16, 2023

1. This quiz is closed book, closed notes. You may have one 8.5 x 11" crib sheet.
2. Show all work necessary to complete the problem. A solution without the appropriate work shown will receive no credit. A solution which is not given in a reasonable order will lose credit.
3. Show all units in solutions, intermediate results, and figures. Units in the quiz will be included between square brackets.
4. If the grader has difficulty following your work because it is messy or disorganized, you will lose credit.
5. Do not use red ink. Do not use red pencil.
6. You will have 30 minutes to work on this quiz.

_____ /20

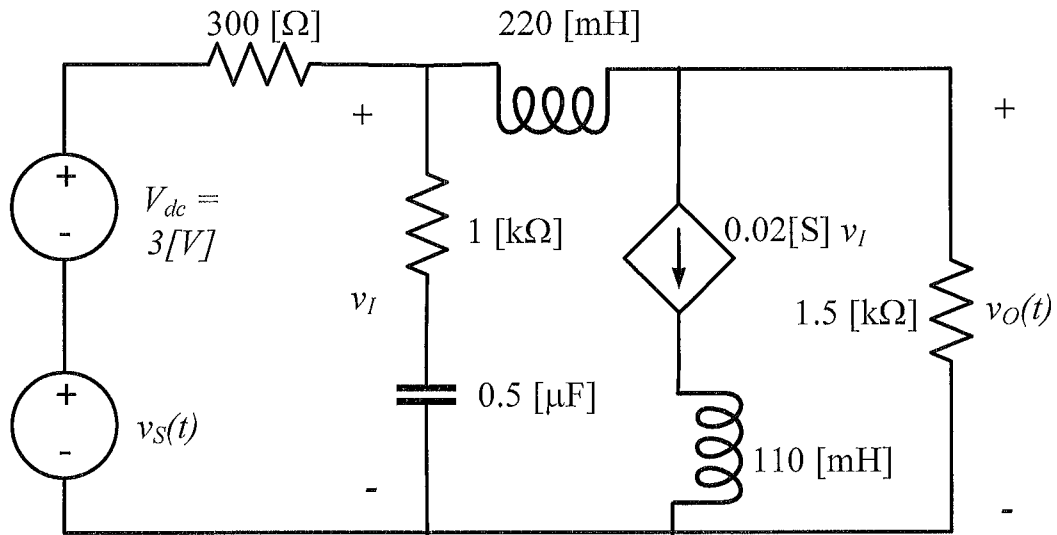
Room for extra work

The circuit below models an amplifier operating in steady state. The input $v_S(t)$ is produced by a microphone into which Dr. Trombetta is singing concert pitch 'A', which has a frequency $f = 440$ [Hz]. The source V_{dc} is a dc source. If

$$v_S(t) = 0.1[V]\sin(\omega t),$$

find $v_O(t)$.

Note: Significant credit will be subtracted for "mixed domains".



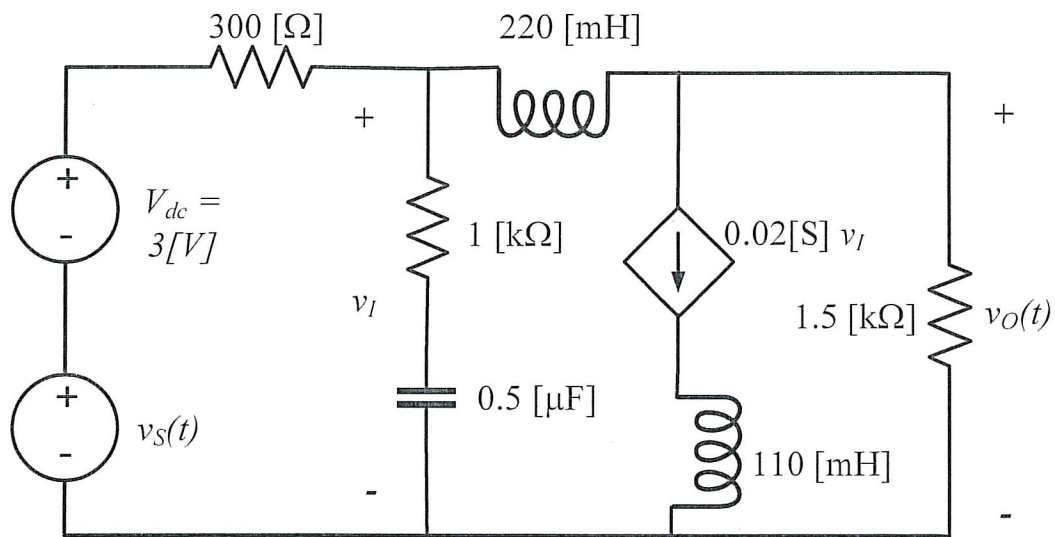
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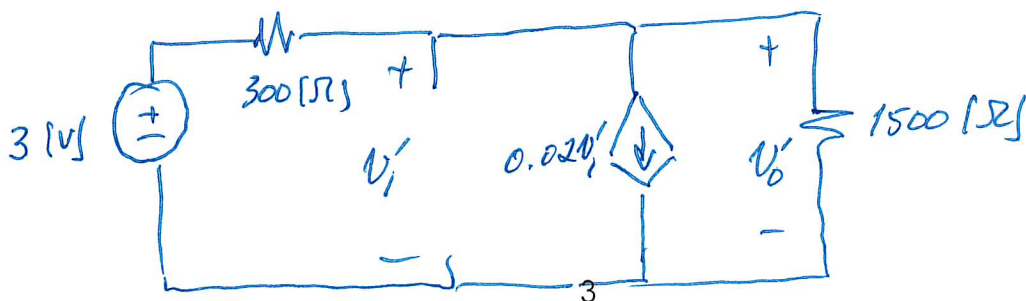


Since there are two sources at different frequencies, we require superposition.

$$V_{dc} = 3[V] \quad \omega = 0 \Rightarrow j\omega L = 0 \Rightarrow L \rightarrow \text{short}$$

$$\Rightarrow \frac{1}{j\omega C} = \infty \Rightarrow C \rightarrow \text{open}$$

So the resulting circuit w... (with $v_S(t) \rightarrow \text{short}$)



✓

Room for extra work

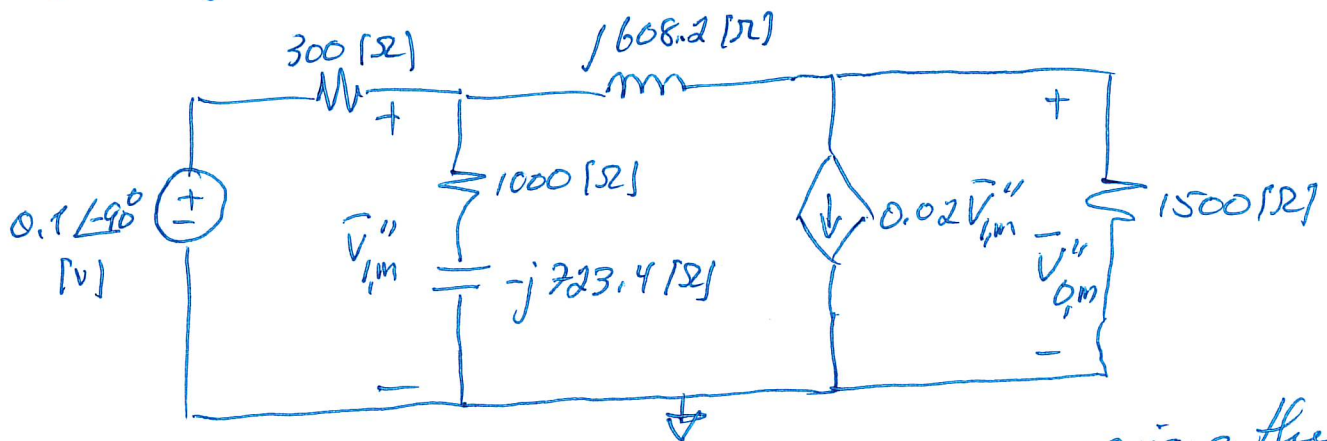
$$\frac{V_1' - 3}{300} + 0.02 V_1' + \frac{V_1'}{1500} = 0$$

$$V_1' = V_0' = 0.4167 \text{ [V]}$$

$$V_0(t) : \omega = 2\pi f = 2\pi(440) = 2764.6 \text{ [rad/s]}$$

$$V_{dc} \rightarrow \text{short} \quad \sin(\omega t) \rightarrow \cos(\omega t - 90^\circ)$$

$$L \rightarrow j\omega L = 608.2 \text{ [\Omega]} \quad C \rightarrow \frac{1}{j\omega C} = -j723.4 \text{ [\Omega]}$$



110 [mH] is in series w/ current source \Rightarrow ignore this.

$$\frac{\bar{V}_{1,m}'' - 0.1 \angle -90^\circ}{300} + \frac{\bar{V}_{1,m}''}{1000 - j723.4} + \frac{\bar{V}_{1,m}'' - \bar{V}_{0,m}''}{j608.2} = 0$$

$$\frac{\bar{V}_{0,m}'' - \bar{V}_{1,m}''}{j608.2} + 0.02 \bar{V}_{1,m}'' + \frac{\bar{V}_{0,m}''}{1500} = 0$$

$$\bar{V}_{1,m}'' = 14.65 \angle -92.8^\circ \text{ [mV]}$$

$$\bar{V}_{0,m}'' = 165.7 \angle 179.8^\circ \text{ [mV]}$$

[rad/s]

$$V_0(t) = V_0' + V_0'' = 0.4167 \text{ [V]} + 0.1657 \cos(2764.6 t + 179.8^\circ) \text{ [V]}$$