

Pre-Lab 4: Operational Amplifiers Part 2

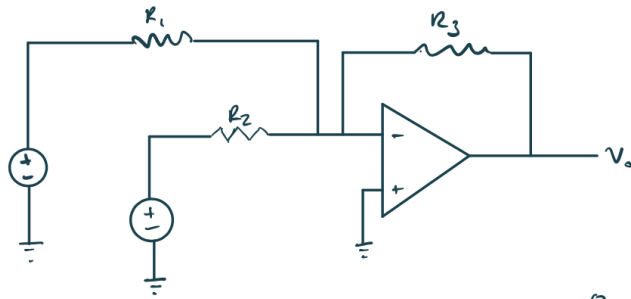
ECEN 325 - 511

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Due Date: October 5, 2021

Calculations

1)



$$R_3 = 15k\Omega$$

$$V_o = - \left(\frac{R_3}{R_1} V_{i1} + \frac{R_3}{R_2} V_o \right)$$

$$V_o = - \left(V_{i1} + 2V_{i2} \right)$$

$$\textcircled{1} \frac{R_3}{R_1} = 1 \quad \textcircled{2} \frac{R_3}{R_2} = 2$$

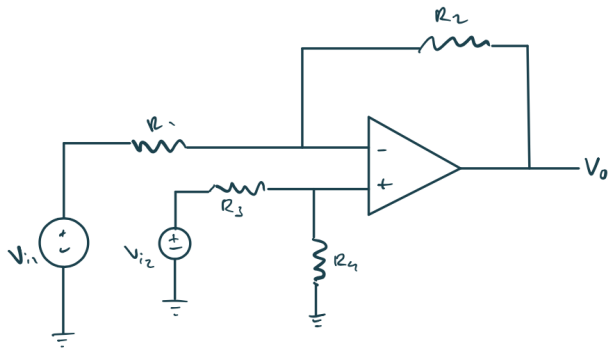
$$\textcircled{1} \frac{R_3}{R_2} = 1 \quad \frac{15k\Omega}{R_1} = 1$$

$$R_1 = 15k\Omega$$

$$\frac{R_3}{R_2} = 2 \quad \frac{15k\Omega}{R_2} = 2$$

$$R_2 = 7.5k\Omega$$

2)



$$\frac{R_2}{R_1} = \frac{R_4}{R_3}$$

$$\text{so } R_3 = R_1 = R_2 = 10k\Omega$$

$$V_o = \frac{R_2}{R_1} (V_{i2} - V_{i1})$$

$$\text{to get } V_o = V_{i2} - V_{i1}$$

$$\frac{R_2}{R_1} = 1$$

$$10k\Omega = R_1$$

$$R_1 = 10k\Omega$$

3) for instrumental amplifiers,

$$V_o = \left(1 + \frac{2R}{R_{\text{gain}}} \right) (V_{i2} - V_{i1})$$

$$V_o = 3(V_{i2} - V_{i1}), \quad R_{\text{gain}} = 1\text{k}\Omega$$

so

$$3 = 1 + \frac{2R}{R_{\text{gain}}}$$

$$3 = 1 + \frac{2R}{1\text{k}\Omega}$$

$$2 = \frac{2R}{1\text{k}\Omega}$$

$$R = 1\text{k}\Omega$$

4) Here $V_{i1} = 0.2 \sin(2\pi 1000t)$

$V_{i2} = 0.3V$

summing amplifier: $V_o = -(V_{i1} - 2V_{i2})$

$V_o = -(0.2 \sin(2\pi 1000t) + (2)(0.3))V$

$V_o = -(0.2 \sin(2\pi 1000t) + 0.6)V$

differential amplifier: $V_o = V_{i2} - V_{i1}$

$V_o = 0.3V - 0.2 \sin(2\pi 1000t)V$

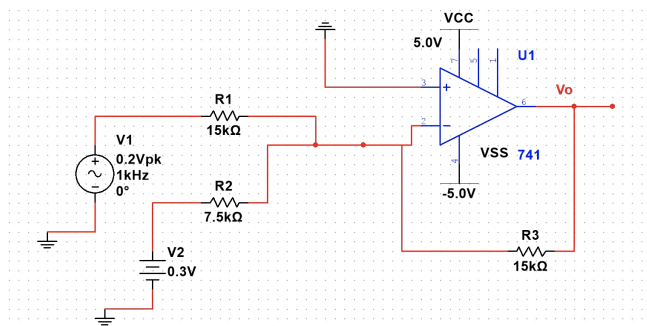
instrumentation amplifier: $V_o = 3(0.3V - 0.2 \sin(2\pi 1000t))V$

$V_o = 0.9V - 0.6 \sin(2\pi 1000t)V$

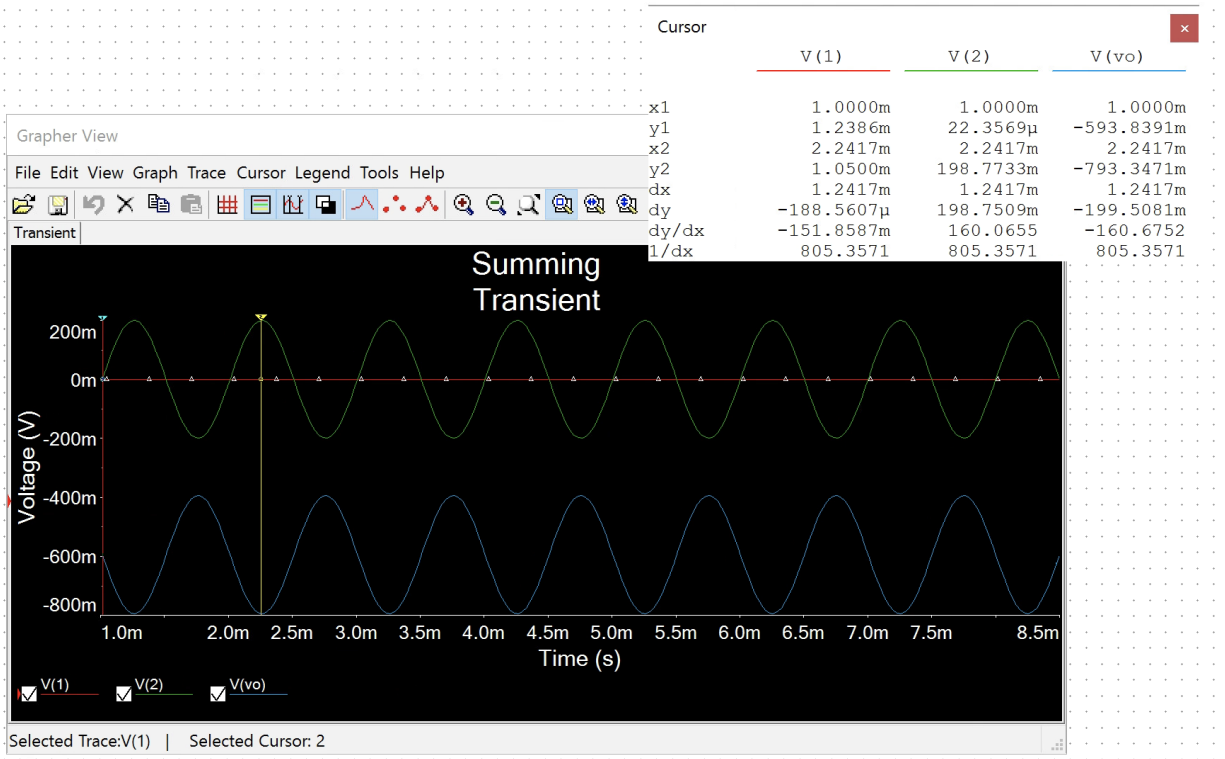
Simulations (on Multisim)

Summing Amplifier

1. Schematic

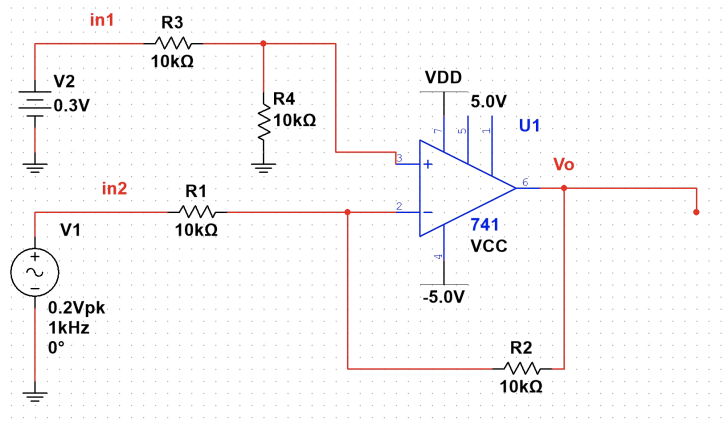


2. Transient

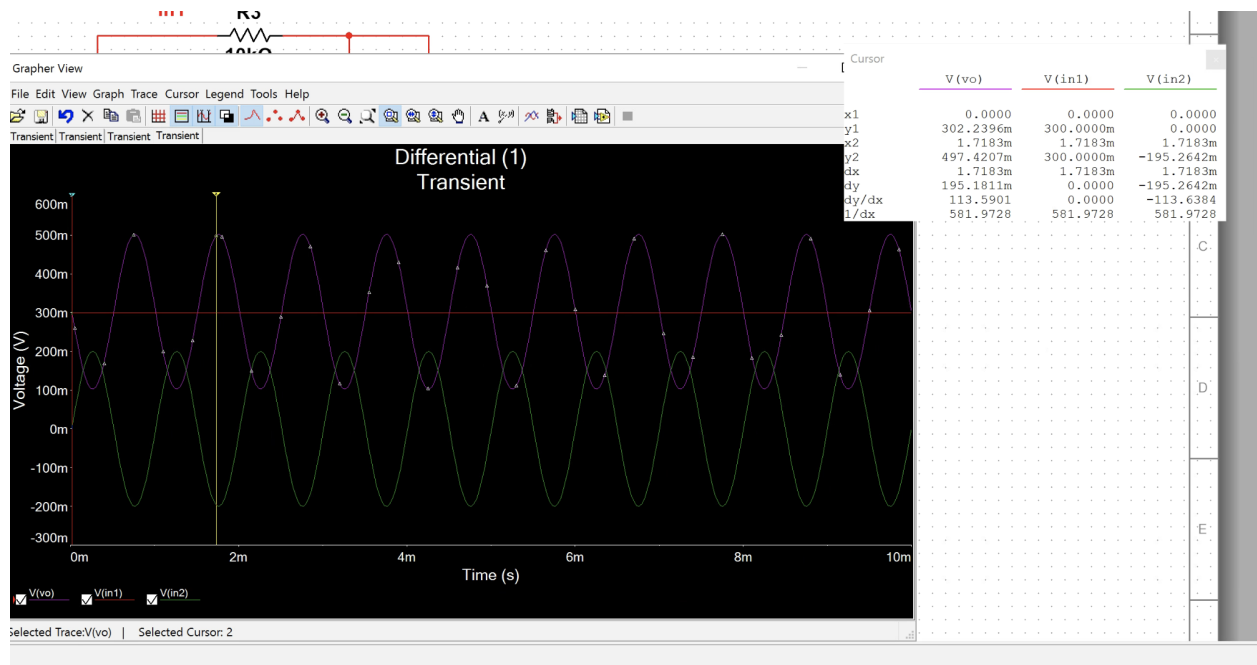


Differential Amplifier

1. Schematic

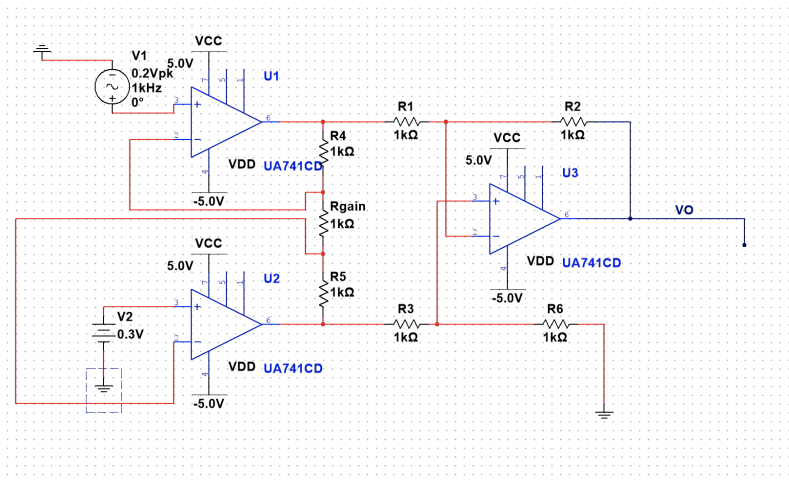


2. Transient



Instrumentation Amplifier

1. Schematic



2. Transient

