

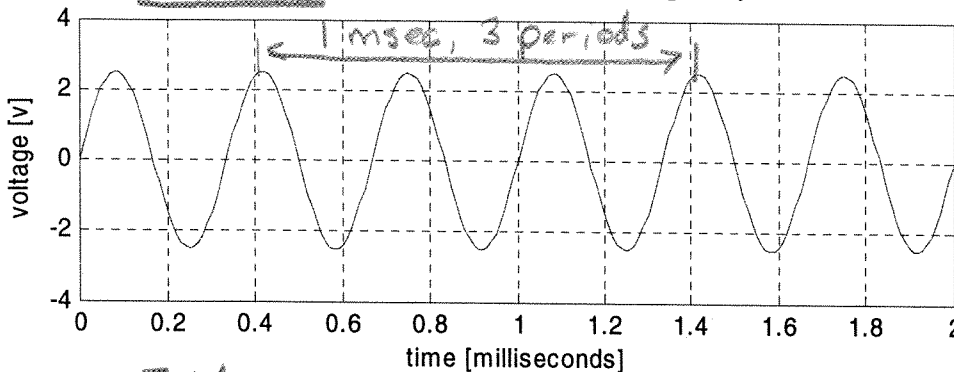
SOLUTION

MAE 106 Post-Laboratory Quiz

Laboratory Exercise #1: Laboratory Tools and Control of a Motor

In Lab 1, you learned how to use the oscilloscope, function generator, breadboard, ohmmeter and potentiometer. You also learned how to use a low power signal, power transistor, and operational amplifier to control the speed of a motor.

1. Estimate the peak-to-peak amplitude, period, and frequency of this sine wave, showing units:

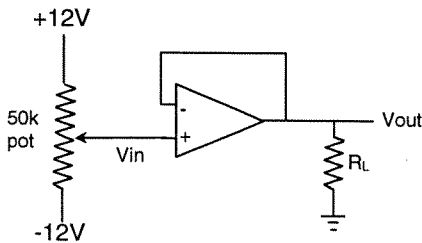


Amplitude: 5 V Period: 0.333 msec Frequency: $\frac{1}{.333e^{-3}} \text{ Hz} = 3000 \text{ Hz}$

2. Match the instrument with its use.

- | | | |
|-----------------------|----------|---|
| a. Potentiometer | <u>b</u> | 1. Building circuits |
| b. Breadboard | <u>a</u> | 2. Measuring the joint angle of a robot arm |
| c. Function Generator | <u>d</u> | 3. Measuring a resistance |
| d. Ohmmeter | <u>e</u> | 4. Measuring voltage as a function of time |
| e. Oscilloscope | <u>c</u> | 5. Producing sine, square, and triangle waves |

3. By exactly how many volts does V_{out} differ from V_{in} in the following circuit? Assume $V_{in} = 5 \text{ V}$, and use the fact that $V_o = K(V_+ - V_-)$ for an op amp, with $K = 5,000$. You may express your answer as a fraction.



$$V_o = K(V_+ - V_-)$$

$$V_o = 5000(V_{in} - V_o)$$

$$V_o(500) = (5000)V_{in}$$

$$V_o = \frac{5000}{500} V_{in}$$

$$V_o - V_{in} = \frac{1}{5001} V_{in}$$

$$= \frac{5}{5001} \text{ V}$$

$$\approx 1 \text{ mV}$$

4. Draw a circuit for feedback control of the voltage across a motor, using a low-power input, an op-amp, and a MOSFET. Make sure to label supply voltage, low-power input, ground, motor, MOSFET, gate, drain, source, motor, op amp.

