

PROBLEM SET #2

Issued: Friday, September 4, 2020

Due: Friday, September 11, 2020, at 12:00 noon via Gradescope.

Reading Assignment: Sedra & Smith, §2.1–2.5, §2.7

Unless otherwise stated, you may assume all op amps are ideal.

1. Sedra & Smith, Problem 2.23
2. For this problem, refer to the op amp circuit in Fig. PS2.1.

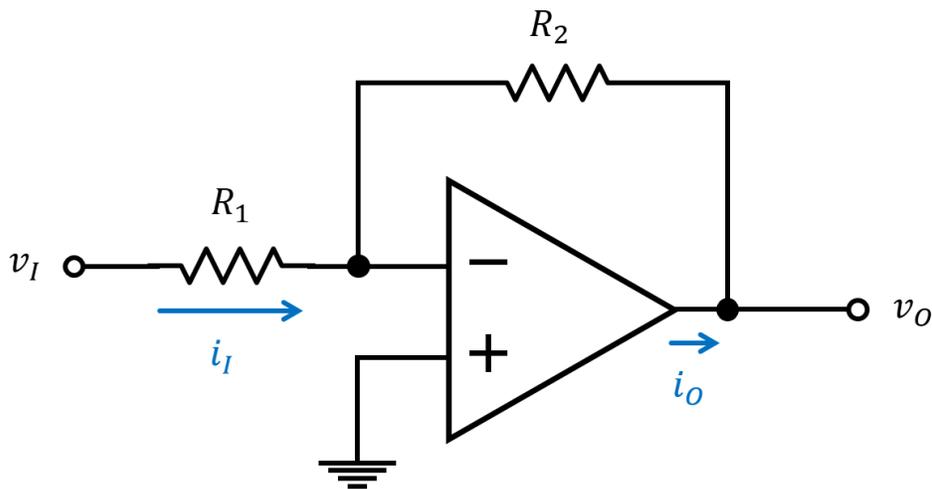


Figure PS2.1

- (a) What are the voltage gain (v_O/v_I), input resistance, and output resistance if $R_1 = 22 \text{ k}\Omega$ and $R_2 = 110 \text{ k}\Omega$?
- (b) What is the output voltage if $v_I = 0 \text{ V}$?
- (c) What is the output voltage if a dc signal $V_I = 0.22 \text{ V}$ is applied to the circuit?
- (d) What is the output voltage if an ac signal $v_I = (0.15) \sin(2500\pi t) \text{ V}$ is applied to the circuit?
- (e) What is the output voltage if the input signal is $v_I = 0.22 - (0.15) \sin(2500\pi t) \text{ V}$?
- (f) What are the input current i_I , op amp output current i_O , and voltage at the inverting input of the op amp, v^- for the input signal in part (d)?

- (g) If the op amp operates with ± 12 V power supplies and the signal $v_i = 0.22 - V_i \sin(2500\pi t)$ is applied, what is the maximum amplitude of the input signal V_i for an undistorted output?

3. For this problem, refer to the op amp circuit in Figure PS2.2.

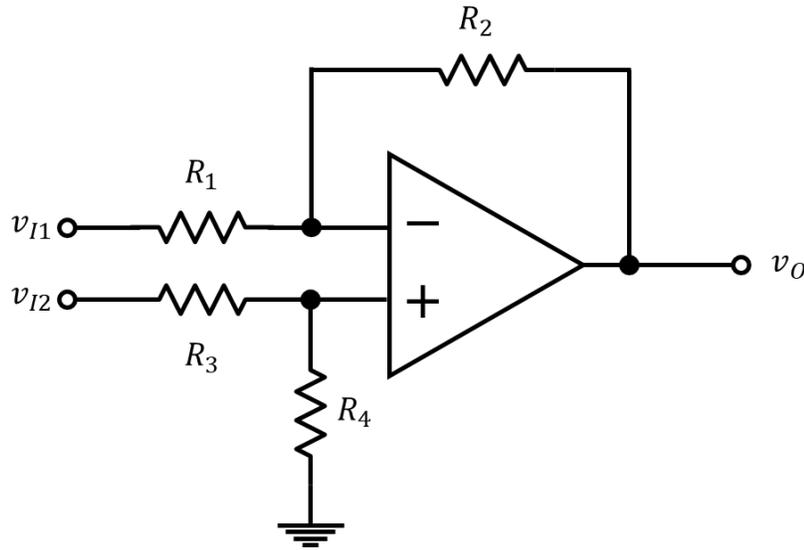


Figure PS2.2

- (a) Find the output voltage, v_o in terms of the two input voltages, v_{I1} & v_{I2} , and R_1 , R_2 , R_3 and R_4 .
- (b) In the special case where $R_1 = R_2 = R_3 = R_4 = R$, what does the expression for v_o reduce to? What “operation” is this op amp performing?
- (c) Find the input resistance seen for the following cases
- A source connected only to the v_{I1} port
 - A source connected only to the v_{I2} port
 - A source connected between the v_{I1} and v_{I2} ports.
 - A source connected to both of the v_{I1} and v_{I2} ports simultaneously.
4. Sedra & Smith, Problem 2.92. Additionally, draw the magnitude and phase Bode plots for the transfer function of your final design.