

ELECTRONIC SYSTEM DESIGN

PART 3: OP AMP APPLICATIONS

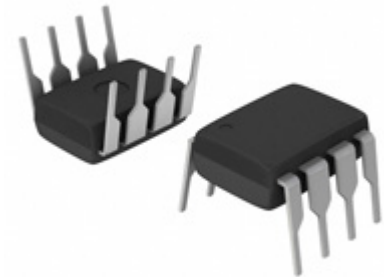
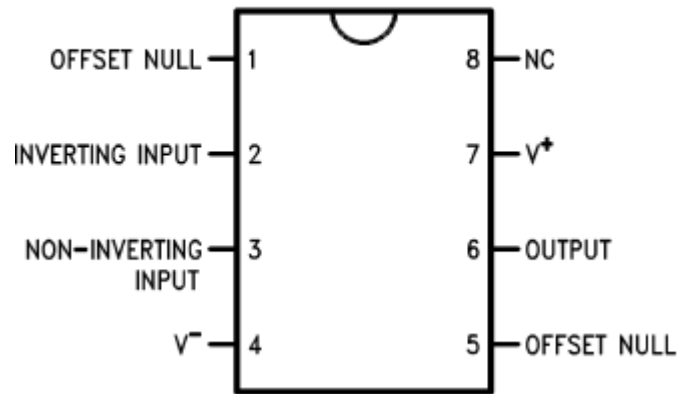
Prof. Yasser Mostafa Kadah

741 Op Amp

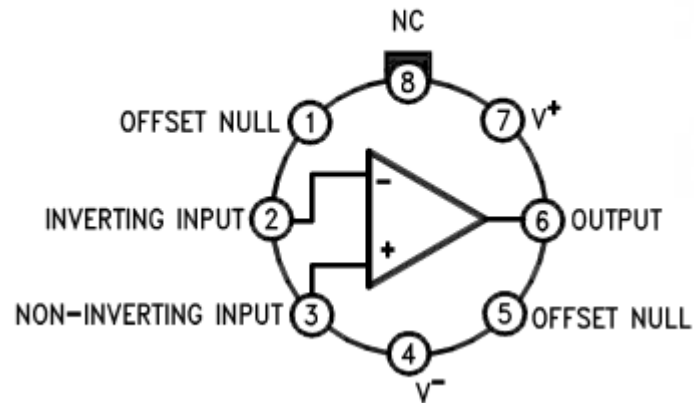
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- Supply range
- GBW product
- Output swing

Dual-In-Line or S.O. Package



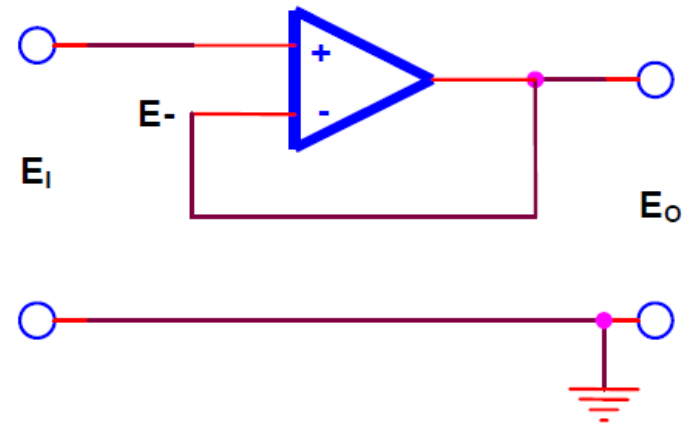
Metal Can Package



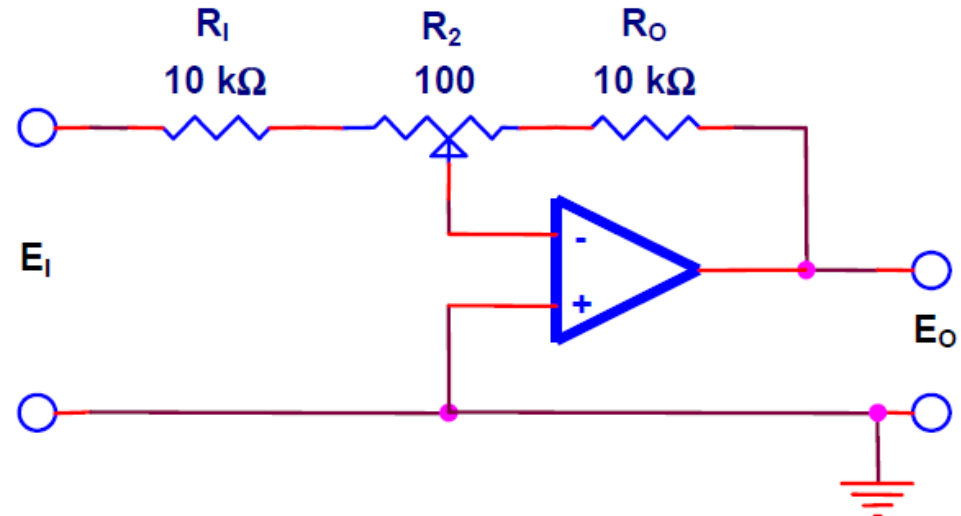
Example OP AMP Circuits

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- Voltage follower



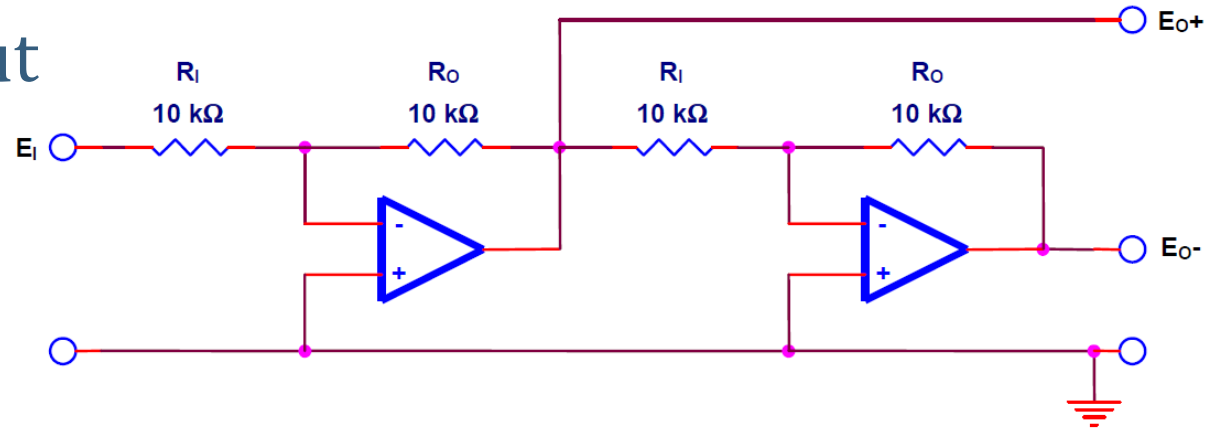
- Inverting Buffer Adjustable Gain



Example OP AMP Circuits

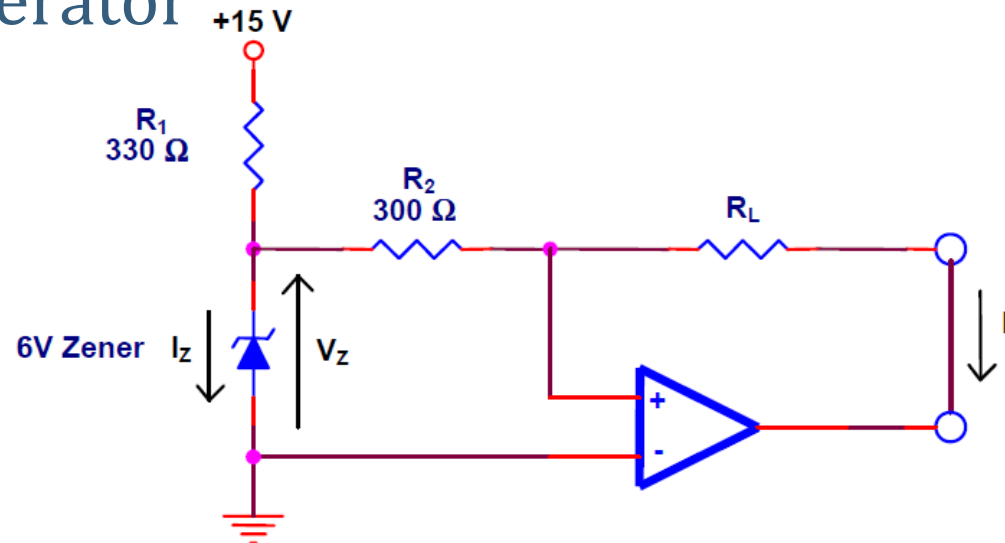
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- Balanced output



- Constant current generator

$$I = \frac{V_Z}{R_2}$$



Example OP AMP Circuits

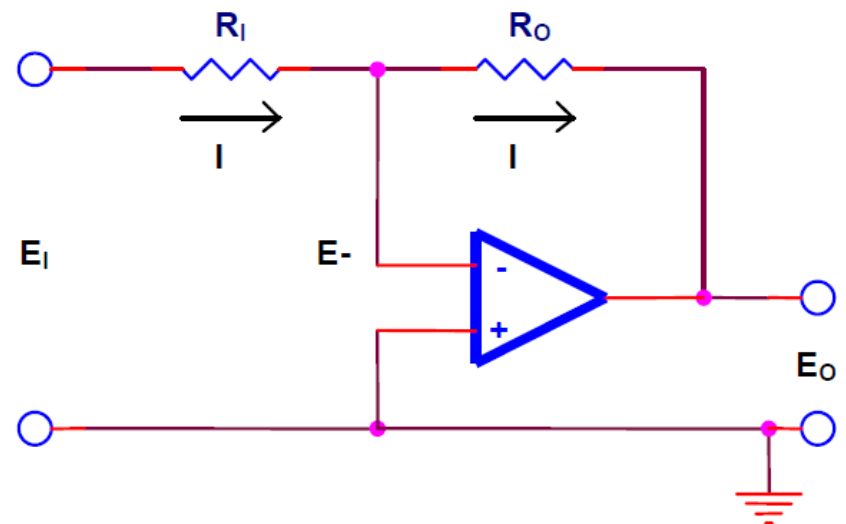
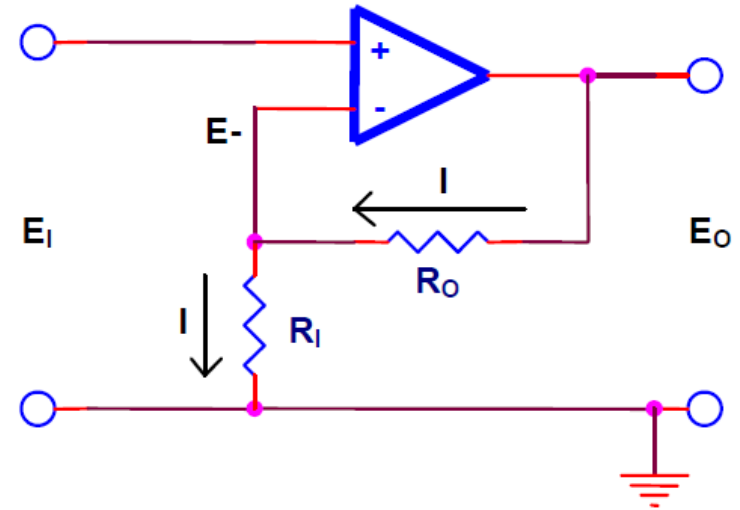
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- Non-inverting amplifier

$$\frac{E_o}{E_i} = \frac{R_o + R_i}{R_i} = 1 + \frac{R_o}{R_i}$$

- Inverting amplifier

$$\frac{E_o}{E_i} = -\frac{R_o}{R_i}$$

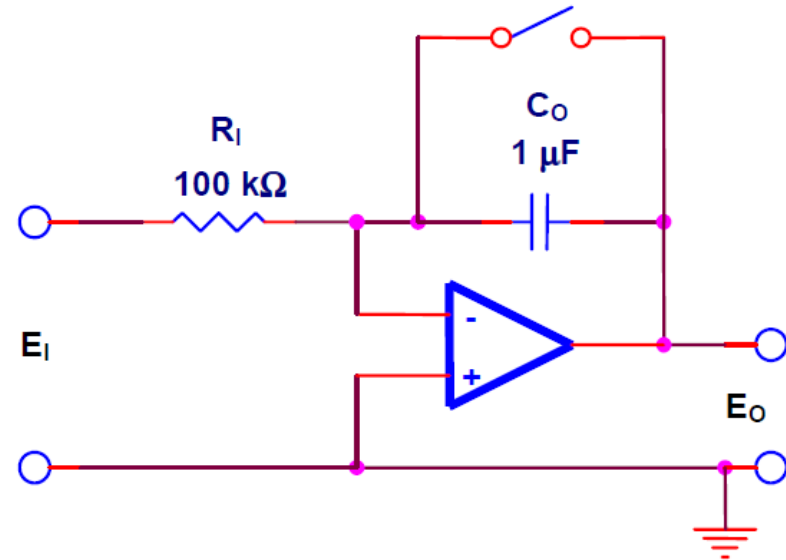


Example OP AMP Circuits

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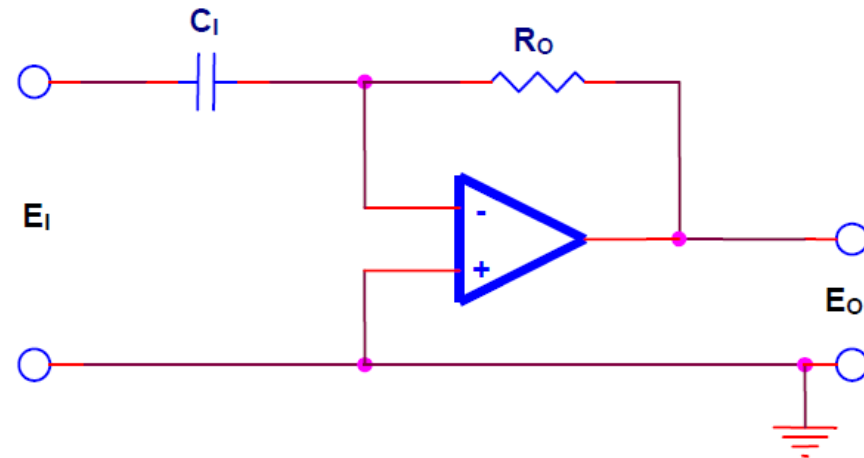
□ Integrator

$$E_o = \frac{-E_i dt}{R_i C_o}$$



□ Differentiator

$$E_o = \frac{-Z_o}{Z_i} E_i = -R_o C_i \frac{dE_i}{dt}$$



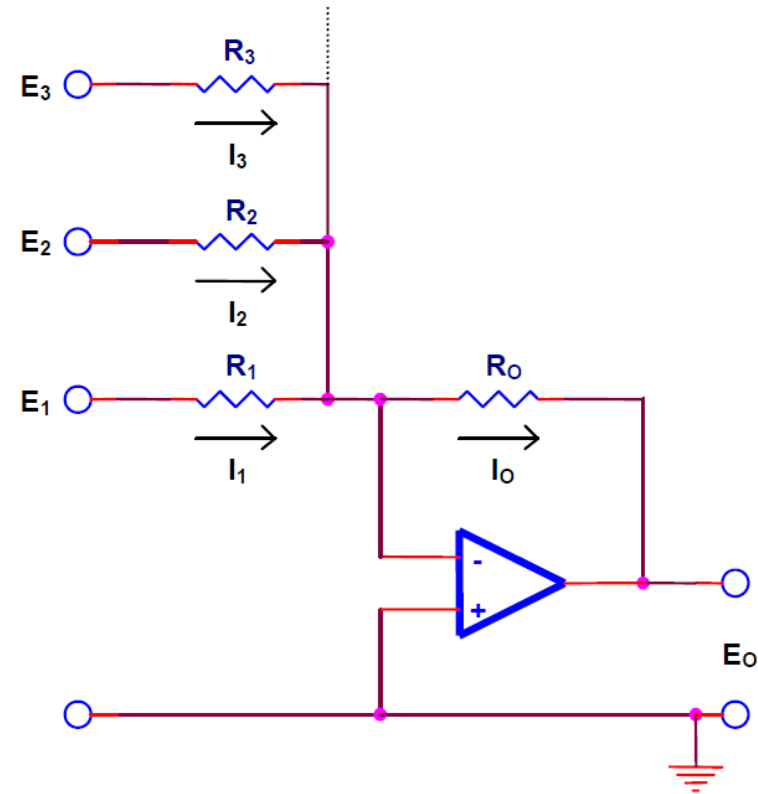
Example OP AMP Circuits

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□ Voltage summer

$$E_o = -R_o \left(\frac{E_1}{R_1} + \frac{E_2}{R_2} + \frac{E_3}{R_3} + \dots \right)$$

- Averager: $R_1=R_2=R_3= 3R_0$
- Summer: $R_1=R_2=R_3=R_0$
- Weighted summer: select R_1, R_2, R_3 to apply weights

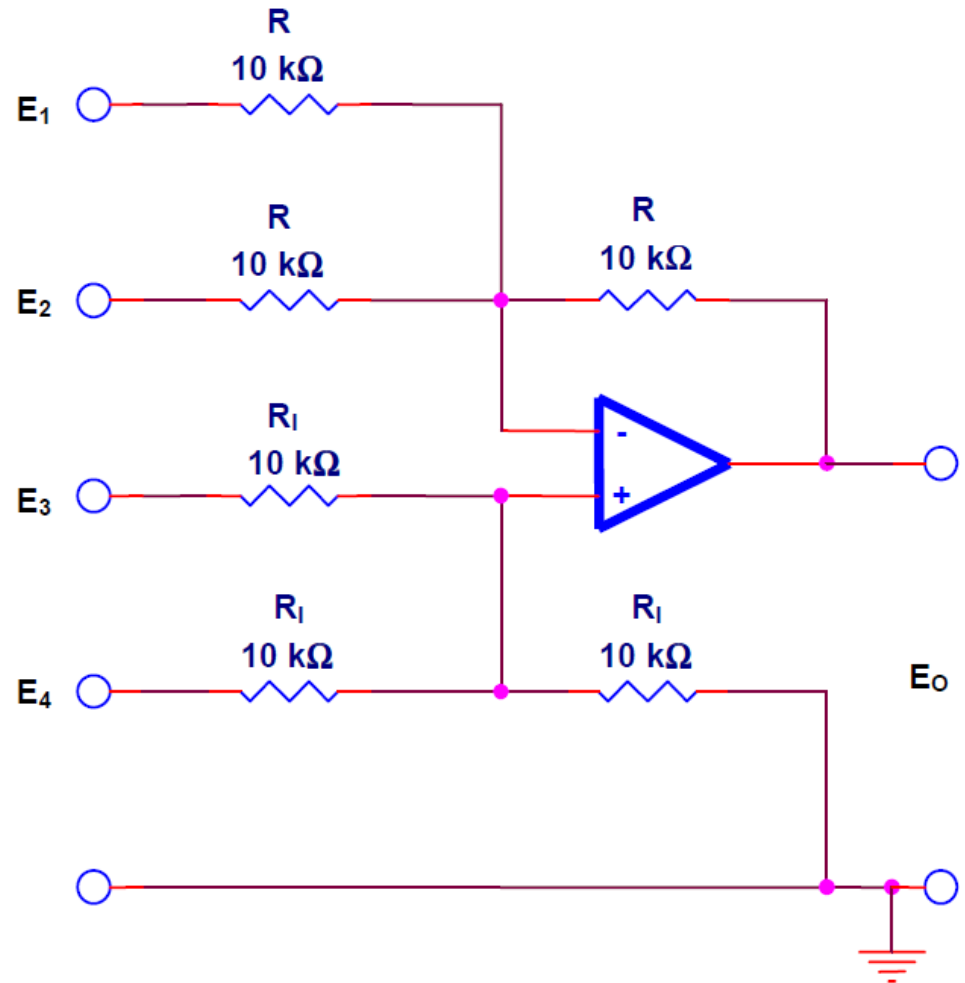


Example OP AMP Circuits

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□ Adder-Subtractor

$$E_o = -E_1 - E_2 + E_3 + E_4$$

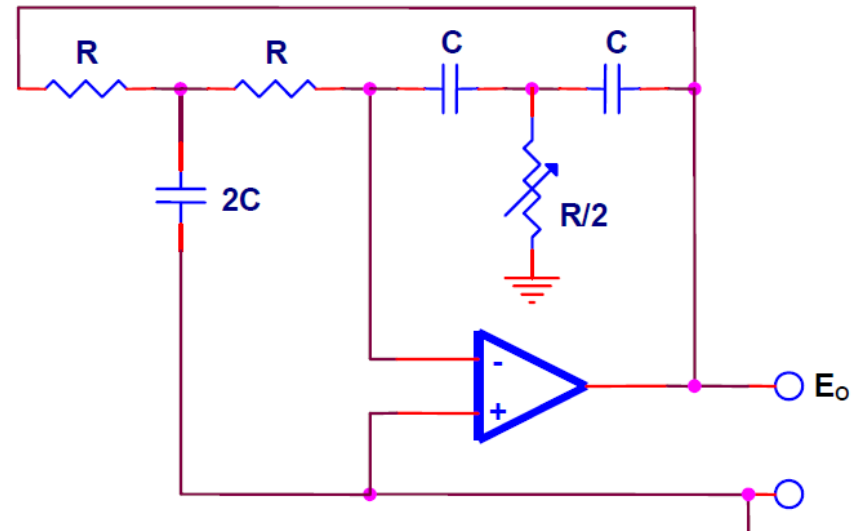


Example OP AMP Circuits

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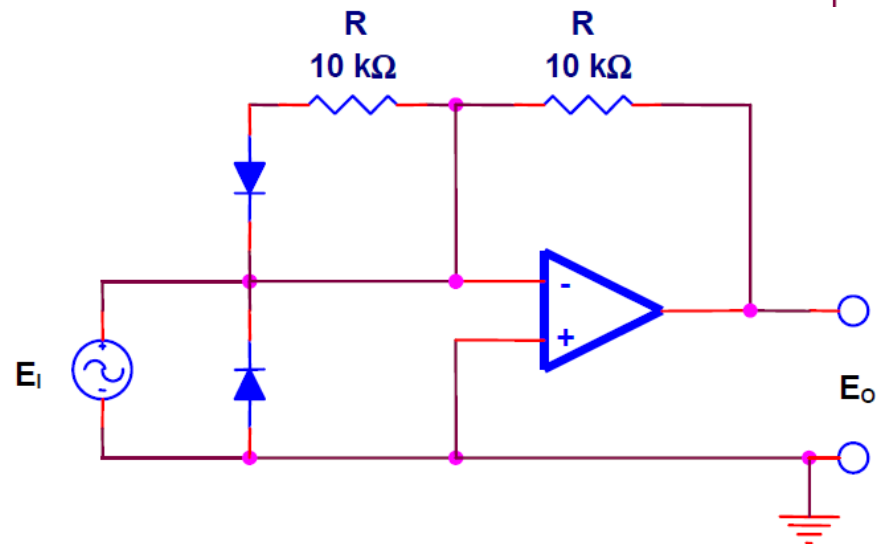
□ Oscillator

$$f = \frac{1}{2\pi RC}$$



□ Absolute value circuit

$$E_o = |E_i|$$

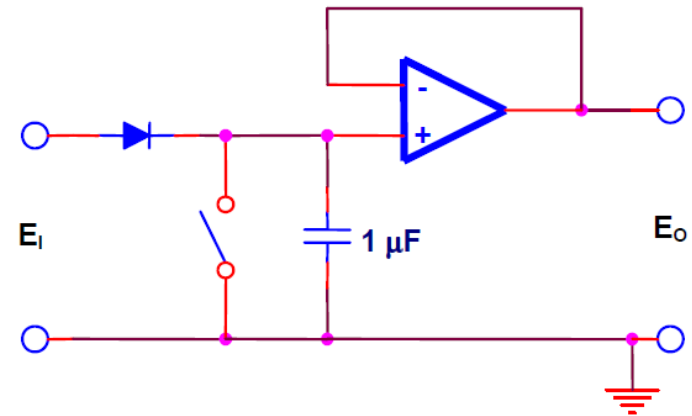


Example OP AMP Circuits

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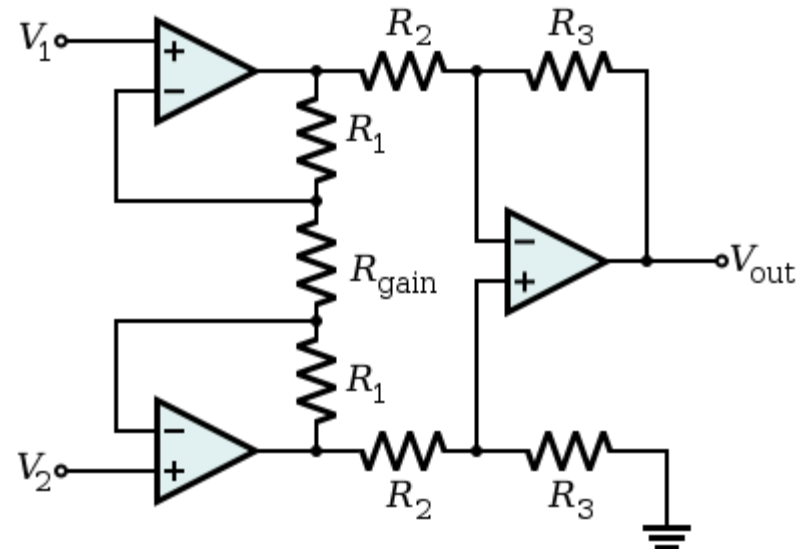
- Peak detector

$$E_o = E_i \text{ maximum}$$



- Instrumentation amplifier

$$\frac{V_{\text{out}}}{V_2 - V_1} = \left(1 + \frac{2R_1}{R_{\text{gain}}}\right) \frac{R_3}{R_2}$$



Assignments

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- Implement 5 Op Amp circuits of your choice and report the results obtained.