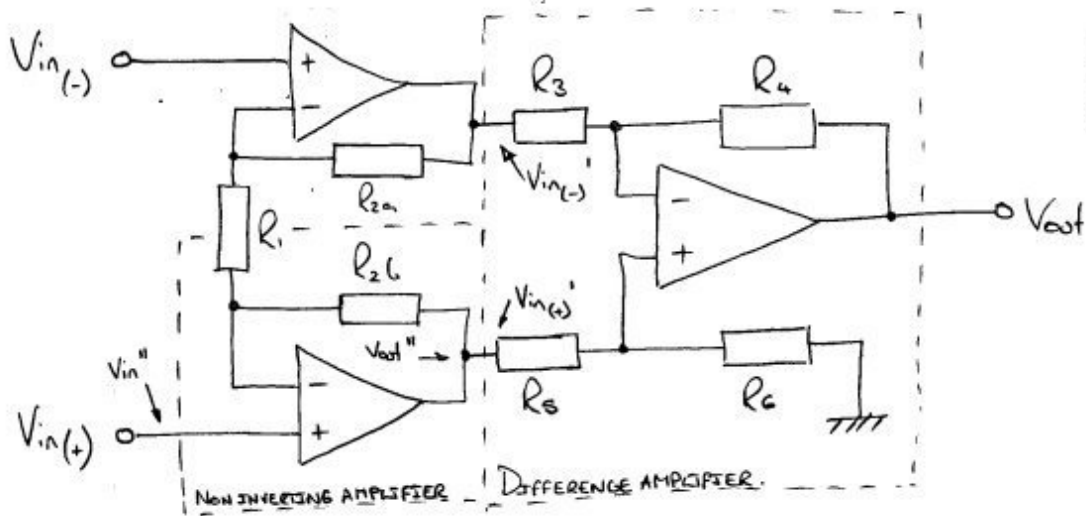


Instrumentation Amplifier

① $V = IR$
 $\frac{V}{R} = I \quad \frac{V}{I} = R$



Non inverting amplifier

$$\frac{V_{out}''}{V_{in}''} = 1 + \frac{R_2}{0.5R_1} = 1 + \frac{2R_2}{R_1}$$

Difference amplifier

$$V_{out} = \frac{V_{in(+)}' \cdot R_6 (R_3 + R_4) - V_{in(-)}' \cdot R_4 (R_5 + R_6)}{R_3 (R_5 + R_6)}$$

IF $V_{in(+)}' = -V_{in(-)}' = V_{in}$ (Differential Input)

$$V_{out} = \frac{V_{in} \cdot R_6 (R_3 + R_4) + V_{in} \cdot R_4 (R_5 + R_6)}{R_3 (R_5 + R_6)}$$

$$\frac{V_{out}}{V_{in}} = \frac{R_6 (R_3 + R_4) + R_4 (R_5 + R_6)}{R_3 (R_5 + R_6)}$$

$$\frac{V_{out}}{V_{in}} = \frac{R_6 (R_3 + R_4)}{R_3 (R_5 + R_6)} + \frac{R_4 (R_5 + R_6)}{R_3 (R_5 + R_6)}$$

$$\frac{V_{out}}{V_{in}} = \frac{R_6 (R_3 + R_4)}{R_3 (R_5 + R_6)} + \frac{R_4}{R_3}$$

IF $V_{in(+)}' = V_{in(-)}' = V_{in}$
 (Common Mode).

$$\frac{V_{out}}{V_{in}} = \frac{R_6 (R_3 + R_4)}{R_3 (R_5 + R_6)} - \frac{R_4}{R_3}$$

So, if $R_3 = R_4 = R_5 = R_6 = 10K$
 and $V_{in(+)}' = V_{in(-)}' = V_{in}$

$$\frac{V_{out}}{V_{in}} = 0$$

$$\text{If } V_{in(+)} = -V_{in(-)} = V_{in}$$

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$$\frac{V_{out}}{V_{in}} = \frac{V_{out}}{V_{in'}} \cdot \frac{V_{out}''}{V_{in}}$$

$$\text{So, } \frac{V_{out}}{V_{in}} = \left(1 + \frac{2R_2}{R_1} \right) \left(\frac{R_6 (R_3 + R_4)}{R_3 (R_5 + R_6)} + \frac{R_4}{R_3} \right)$$