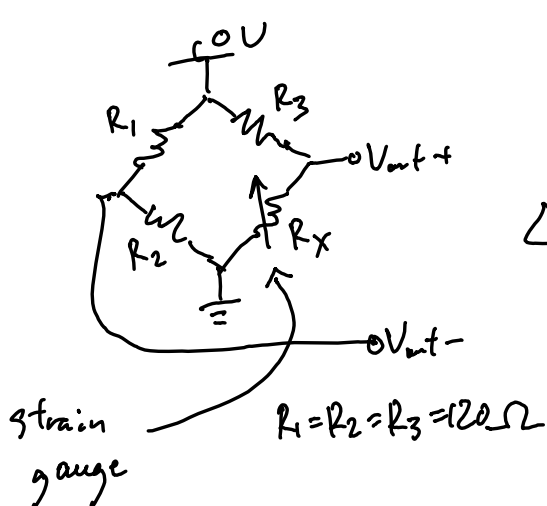


Ch.13 COK book

7) Design a strain gauge circuit based on a Wheatstone bridge.

The nominal resistance of the gauge is 120Ω and the gauge factor is 2. The circuit's output should be 0V with no strain, and have a sensitivity of $0.5\text{ mV}/\mu\epsilon$.



$$\Delta V = V_s \left(\frac{R_x}{R_x + R_3} - \frac{R_2}{R_1 + R_2} \right)$$

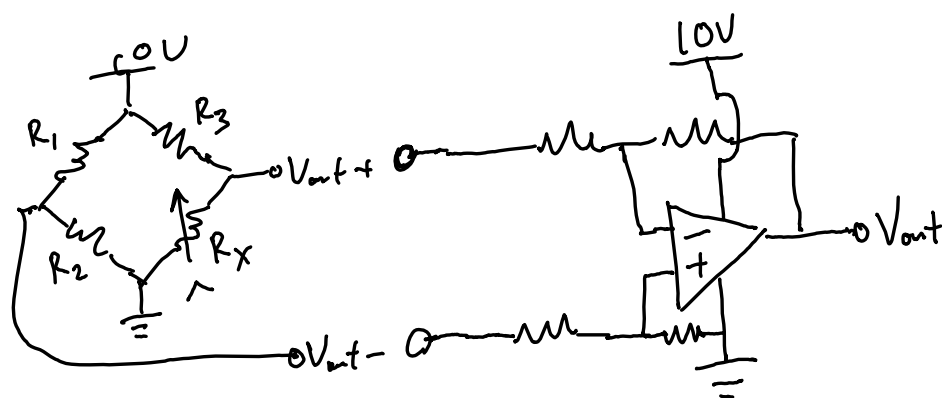
$$G.F. = \frac{\Delta R / R_{\text{nominal}}}{\epsilon} = 2$$

$$\begin{aligned} \Delta R \text{ for } 1\mu\epsilon &: G.F. \cdot R_{\text{nominal}} \cdot \frac{1 \cdot 10^{-6} \epsilon}{1\mu\epsilon} \\ &= 2 \cdot 120\Omega \cdot 10^{-6} \\ &= 240\mu\Omega \end{aligned}$$

$$\frac{1.1}{2.1} > \frac{1}{2}$$

$$\begin{aligned} \Delta V \text{ for } 1\mu\epsilon &= V_s \left(\frac{R_x}{R_x + R_3} - \frac{R_2}{R_1 + R_2} \right) \\ &= 10V \left(\frac{120 + 240 \cdot 10^{-6}}{240 + 240 \cdot 10^{-6}} - \frac{1}{2} \right) \\ &= 5\mu V \end{aligned}$$

$\Rightarrow$ sensitivity : $5\mu V/\mu\epsilon$
 want : $500\mu V/\mu\epsilon$ $\nearrow \times 100$



Differential amplifier w/ $A_{cl} = 100$