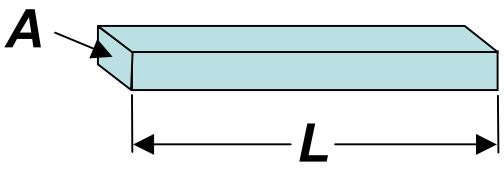
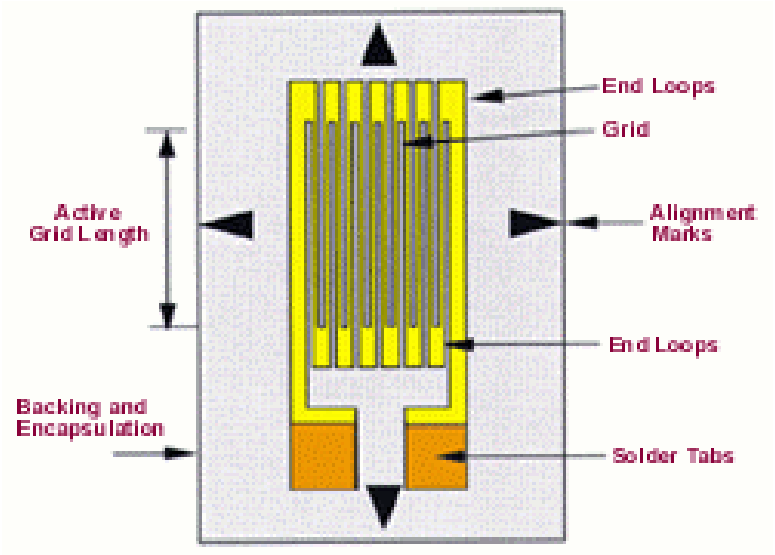
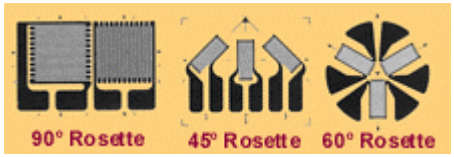
Foil Strain Gauges







$$R = \rho \frac{L}{A}$$

$$dR = \rho \frac{dL}{A} - \rho \frac{L}{A^2} dA + \frac{L}{A} d\rho$$

$$\frac{dR}{R} = \frac{dL}{L} - \frac{dA}{A} + \frac{d\rho}{\rho}$$

$$\frac{dD}{D} = -\mu \frac{dL}{L}$$

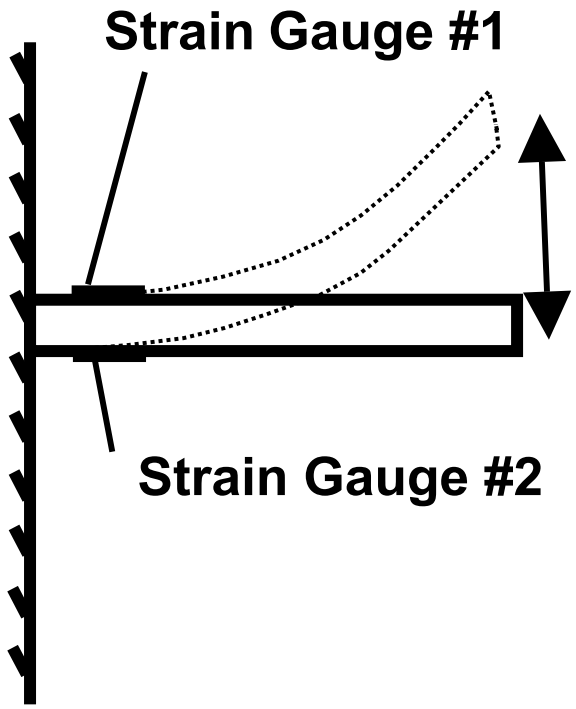
$$A = \frac{\pi D^2}{4} \Rightarrow dA = \frac{2\pi D}{4} dD$$

$$\frac{dA}{A} = \frac{\frac{\pi D}{2} dD}{\frac{\pi D^2}{4}} = 2\frac{dD}{D} = -2\mu \frac{dL}{L}$$

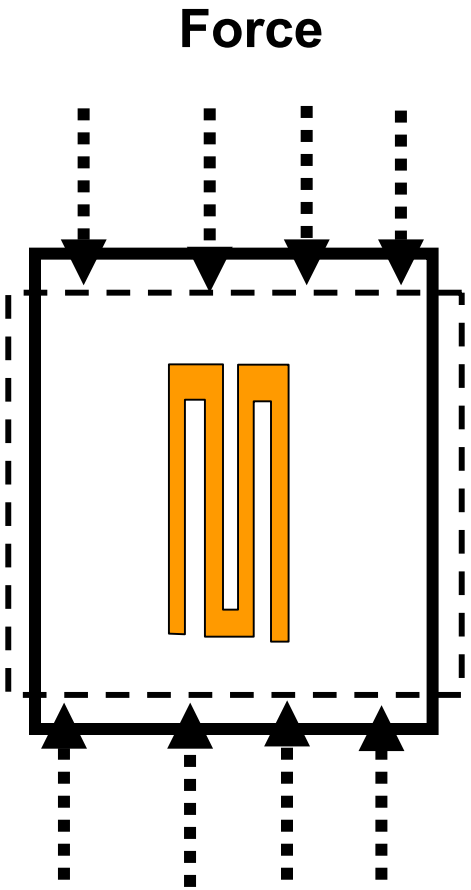
$$\frac{dR}{R} = (1 + 2\mu)\frac{dL}{L} + \frac{d\rho}{\rho}$$

$$\gamma = \frac{dR/R}{dL/L} = (1 + 2\mu)\frac{d\rho/\rho}{dL/L}$$

Applications of Foil Strain Gauges



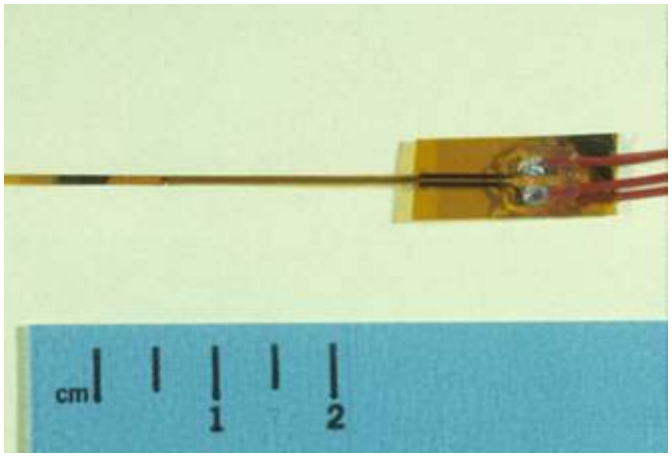
Mechanical Impedance Transformation

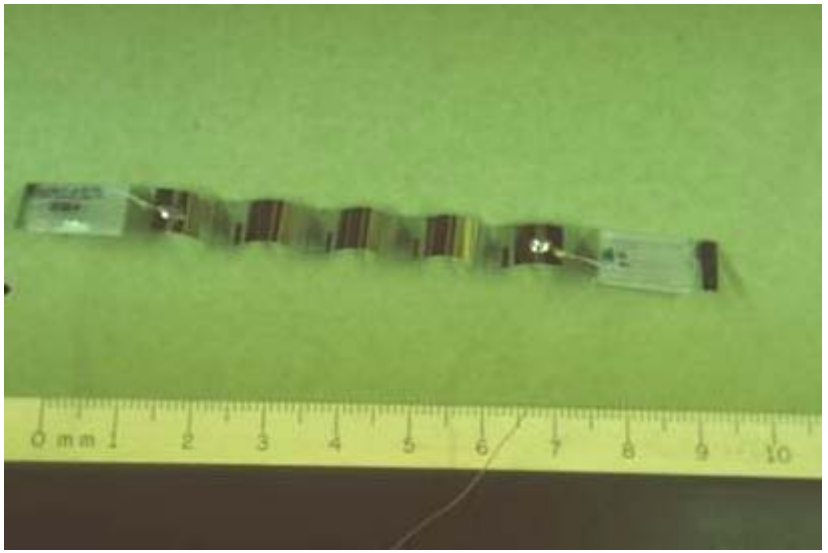


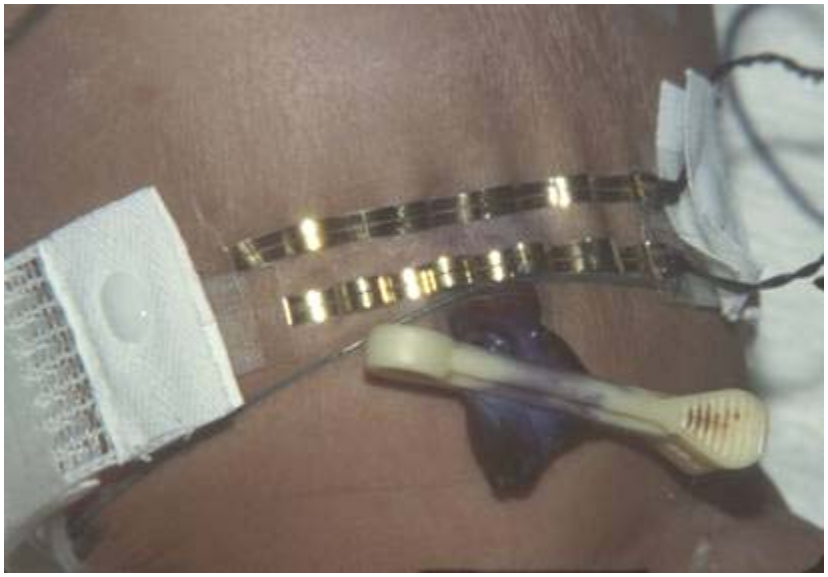
Force

Load Cell

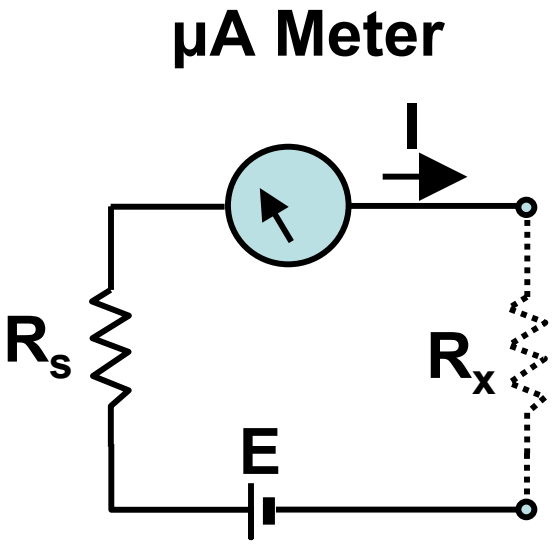
Biomedical Applications of Strain Gauges





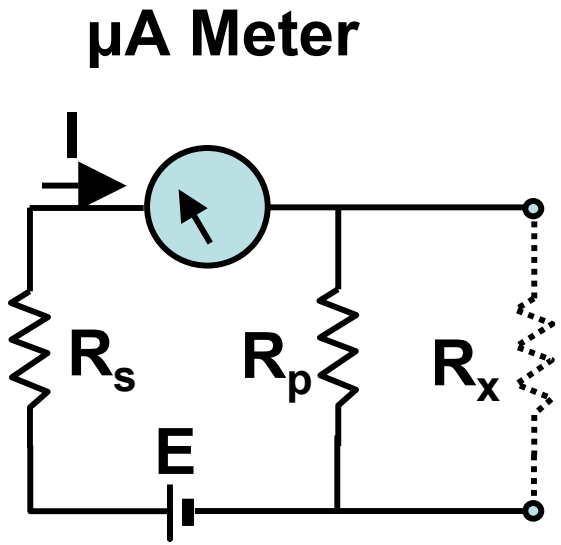


Ohmmeters



Series

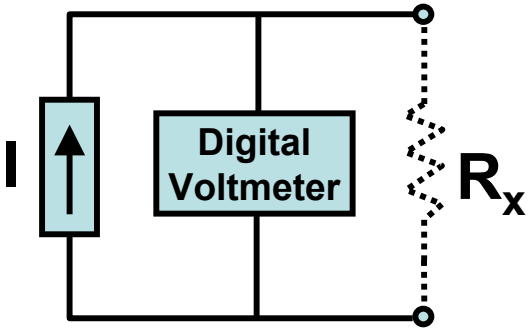
$$I = \frac{E}{R_s + R_p}$$



Shunt

$$I = \frac{E}{R_s + \frac{R_p R_x}{R_p + R_x}}$$

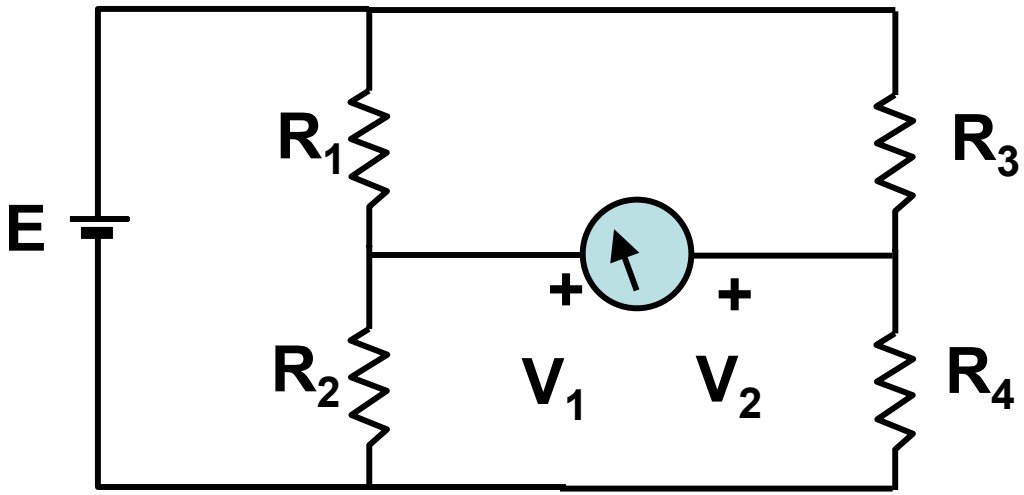
$$I = \frac{E(R_p + R_x)}{R_s(R_p + R_x) + R_p R_x}$$



Digital

$$V = IR_x$$

Wheatstone Bridge



$$V_1 = \frac{R_2}{R_1 + R_2} E$$

$$V_2 = \frac{R_4}{R_3 + R_4} E$$

For the meter to read zero

$$V_1 = V_2$$

$$\frac{R_2}{R_1 + R_2} E = \frac{R_4}{R_3 + R_4} E$$

$$R_2(R_3 + R_4) = R_4(R_1 + R_2)$$

$$R_2 R_3 = R_1 R_4$$

$$\text{or} \quad \frac{R_1}{R_2} = \frac{R_3}{R_4}$$

Linear Variable Differential Transformer (LVDT)