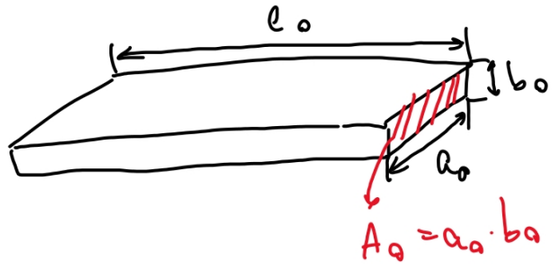
Seminar 1 SIS:

Marca tensometrică (strain gage).

sensibilitatea $S = \dfrac{\frac{\Delta R}{R_0}}{\frac{\Delta l}{l_0}}$ ("gage factor").



a_0, b_0, l_0, R_0 → măsuri în stare nedeformată,

coef. Poisson: $\mu = -\dfrac{\frac{\Delta a}{a_0}}{\frac{\Delta l}{l_0}} = -\dfrac{\frac{\Delta b}{b_0}}{\frac{\Delta l}{l_0}}$

constantă de material: k.

rezistivitatea, ρ

$$R = \rho \cdot \frac{l}{A}$$

$$\frac{1}{R_0} = \frac{A_0}{\rho_0 l_0}$$

$$\Delta R = \Delta\rho \cdot \frac{l_0}{A_0} + \frac{\rho_0}{A_0} \cdot \Delta l + \rho_0 \cdot l_0 \cdot \Delta\left(\frac{1}{A}\right) =$$

$$= \Delta\rho \cdot \frac{l_0}{A_0} + \Delta l \frac{\rho_0}{A_0} - \frac{1}{A_0^2} \cdot \Delta A \cdot \rho_0 \cdot l_0 \quad \Big| \cdot \frac{1}{R_0}$$

$$\frac{\Delta R}{R_0} = \Delta\rho \cdot \frac{l_0}{A_0} \cdot \frac{A_0}{\rho_0 l_0} + \Delta l \cdot \frac{\rho_0}{A_0} \cdot \frac{A_0}{\rho_0 l_0} - \frac{1}{A_0} \cdot \frac{\rho_0 l_0}{A_0} \cdot \frac{A_0}{\rho_0 l_0} \cdot \Delta A$$

$$\boxed{\frac{\Delta R}{R_0} = \frac{\Delta \rho}{\rho_0} + \frac{\Delta l}{l_0} - \frac{\Delta A}{A_0}} \quad *$$

$A = a \cdot b$

$A_0 = a_0 b_0$

$$\frac{\Delta A}{A_0} = \frac{\Delta a \cdot b_0}{a_0 b_0} + \frac{\Delta b \cdot a_0}{a_0 b_0} = \frac{\Delta a}{A_0} + \frac{\Delta b}{b_0}$$

$$\mu = -\frac{\frac{\Delta a}{a_0}}{\frac{\Delta l}{l_0}} = -\frac{\frac{\Delta b}{b_0}}{\frac{\Delta l}{l_0}}$$

$$\Rightarrow \boxed{\frac{\Delta A}{A_0} = -2\mu \cdot \frac{\Delta l}{l_0}} \quad **$$

$*, ** \Rightarrow$

$$\frac{\Delta R}{R_0} = \frac{\Delta l}{l_0} + 2\mu \frac{\Delta l}{l_0} + \frac{\Delta \rho}{\rho_0}$$

$$\frac{\Delta R}{R_0} = (1 + 2\mu) \frac{\Delta l}{l_0} + \frac{\Delta \rho}{\rho_0}$$

Pt. metale $\frac{\Delta \rho}{\rho_0}$ e neglijabil $\Rightarrow$

$$\Rightarrow S = \frac{\frac{\Delta R}{R_0}}{\frac{\Delta l}{l_0}} \simeq 1 + 2\mu$$

pt. metale: $\mu \simeq 0.3 - 0.4 \Rightarrow$

$\Rightarrow \boxed{S \simeq 2.}$

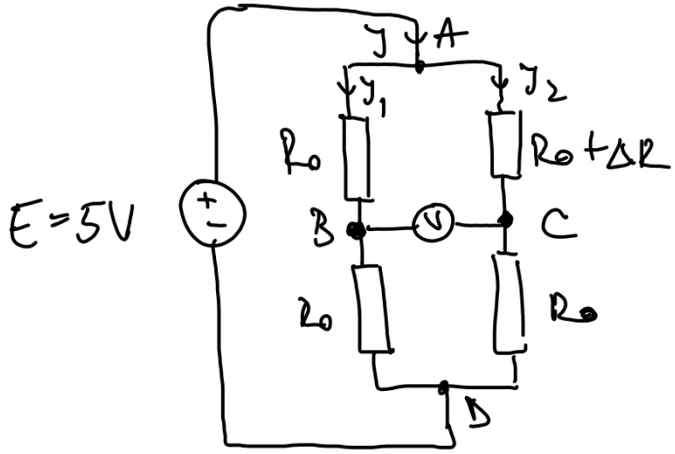
pt. semiconductori $S = 100$

Traductor de deformare:

marca tensometrică: $R_0 = 120\ \Omega$

$\Delta R = 0.1\ \Omega.$

$S = ?\ \left(V/\Omega\right)$

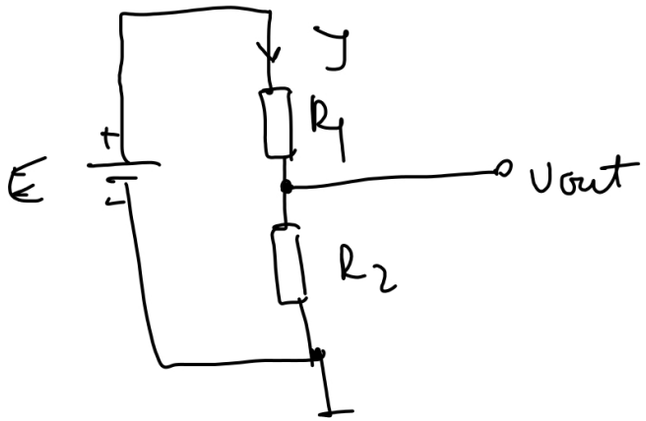


$\mathcal{E} = V_B - V_C$

$\mathcal{E} = U_{BD} - U_{CD}.$

$U_{BD} = 2.5V$

$E = U_{AC} + U_{CD} = I_2 \left(R_0 + \Delta R + R_0\right)$



$$E = J(R_1 + R_2)$$

$$V_{out} = J \cdot R_2$$

$$V_{CD} = J_2 \cdot R_0$$

$$\frac{V_{CD}}{E} = \frac{J_2 R_0}{J_1 (R_0 + \Delta R + R_0)}$$

$$V_{CD} = E \cdot \frac{R_0}{2R_0 + \Delta R}$$

$$\varepsilon = \frac{E}{2} - E \cdot \frac{R_0}{2R_0 + \Delta R}$$

OUT $\rightarrow \varepsilon$

IN $\rightarrow \Delta R$

$\Delta R_{min} = 0$

$\Delta R_{max} = 0.1$

$\varepsilon_{min} = ?$

$\varepsilon_{max} = ?$

$$S = \frac{\varepsilon_{max} - \varepsilon_{min}}{\Delta R_{max} - \Delta R_{min}} = ?$$