Experimental Mechanics : 17 Sept 2018

Notes on

- Electrical Resistance Strain Gauge : (ER)
  - → $R(\epsilon, \text{material})$: resistance is a function of strain and material
  - → Wheatstone bridges used for $\Delta R \to \Delta V$
- Strain Sensitivity

- L : length
- ρ : resistivity [Ω·m]
- A : area

→ with increased ε, increased R

→ "$R = \rho L/A$", but is it from "ρ" or from "L/A"

$$R = \rho L/A \quad \to \quad dR = \frac{1}{A}\left(L\,d\rho + \rho\,dL - L\frac{dA}{A}\right)$$

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

$A = \frac{1}{4}\pi d^2$

Poisson's Ratio or change in transverse cross section : $\nu = -\frac{\varepsilon_T}{\varepsilon_A}$

$\frac{dL}{L} = \varepsilon$

$$d_f = d_0\left(1 - \nu\frac{dL}{L}\right)$$

$$\frac{dA}{A} = -2\nu\frac{dL}{L} + \nu^2\left(\frac{dL}{L}\right)^2 \cong -2\nu\frac{dL}{L}$$

$$\frac{dR}{R} = \frac{d\rho}{\rho} + \varepsilon + 2\nu\varepsilon$$

$$S_\varepsilon = \frac{dR/R}{\varepsilon} = 1 + 2\nu + \frac{d\rho/\rho}{\varepsilon} \quad : \text{Strain Sensitivity}$$

$1 + 2\nu$: change in dimension

$\frac{d\rho/\rho}{\varepsilon}$: change in specific resistance { dependent of the free electrons of material }

$\epsilon [1.4, 1.7]$ $\quad \epsilon^? [1, 3]$