Experimental Mechanics : 24 Sept. 2018

Notes on Strain Analysis

- Stress transformation

→ $\varepsilon_A = \varepsilon_{xx}\cos^2\theta_A + \varepsilon_{yy}\sin^2\theta_A + \gamma_{xy}\sin\theta_A\cos\theta_A$

→ $\varepsilon_B = \varepsilon_{xx}\cos^2\theta_B + \varepsilon_{yy}\sin^2\theta_B + \gamma_{xy}\sin\theta_B\cos\theta_B$

→ $\varepsilon_C = \varepsilon_{xx}\cos^2\theta_C + \varepsilon_{yy}\sin^2\theta_C + \gamma_{xy}\sin\theta_C\cos\theta_C$

} Principal Stress by Mohr's Circle

- Mohr's Circle on

→ $\varepsilon_{1,2} = \frac{1}{2}(\varepsilon_{xx} + \varepsilon_{yy}) \pm \frac{1}{2}\sqrt{(\varepsilon_{xx} - \varepsilon_{yy})^2 - \gamma_{xy}^2}$

→ $\tan 2\phi = \frac{\gamma_{xy}}{\varepsilon_{xx} - \varepsilon_{yy}}$

- Correction factors of Strain Gages (Transverse Effects)

→ $\varepsilon_a = \varepsilon_a' \frac{1 - \nu K_t}{1 + K_t\left(\varepsilon_t/\varepsilon_a\right)}$; $K_t = \frac{S_t}{S_a}$: S_t : transverse sensitivity, S_a : axial sensitivity

ε_a' ↑ Measured Value

$\varepsilon_t/\varepsilon_a$ ← Must be a known ratio

→ Correction Factor (S_a)

$S_g = \frac{\Delta R/R}{\varepsilon_a}$; $S_a^* = S_a\left(\frac{1}{C.F}\right)$; C.F is provided correction factor

→ $\varepsilon_{xx}' = \frac{1}{1 - \nu K_t}\left(\varepsilon_{xx} + K_t\varepsilon_{yy}\right)$

$\varepsilon_{yy}' = \frac{1}{1 - \nu K_t}\left(\varepsilon_{yy} + K_t\varepsilon_{xx}\right)$

} Apparent related to actual strain in 2 equations

- Optical Measurements of Strain

→ Topics : Wave theory of Light → Wave Equation → Superposition → Polarization . . .