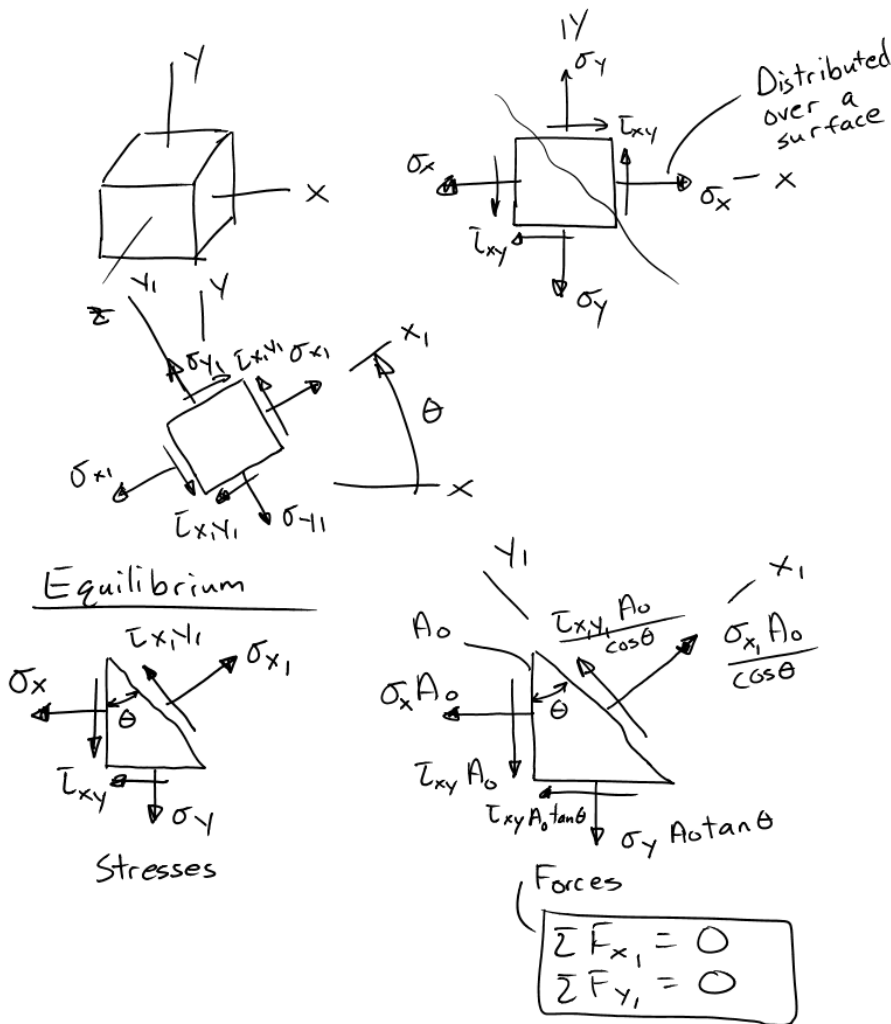


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 Analysis of Stresses and Strains – Stress Formulas

Stress Formulas

- Have been for a cross-section (vertical cut)
- The maximum stress could occur at an inclined section/cut



- Result of simplifying the equations

$$\sigma_{x_1} = \frac{\sigma_x + \sigma_y}{2} + \frac{\sigma_x - \sigma_y}{2} \cos 2\theta + \tau_{xy} \sin 2\theta$$


$$\tau_{x_1 y_1} = -\left(\frac{\sigma_x - \sigma_y}{2} \sin 2\theta\right) + \tau_{xy} \cos 2\theta$$

$$\sigma_{y_1} = \frac{\sigma_x + \sigma_y}{2} - \frac{\sigma_x - \sigma_y}{2} \cos 2\theta - \tau_{xy} \sin 2\theta$$

$$\sigma_{x_1} + \sigma_{y_1} = \sigma_x + \sigma_y$$

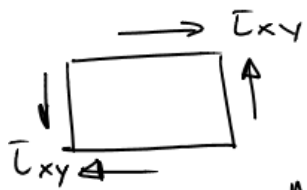
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- Special Cases



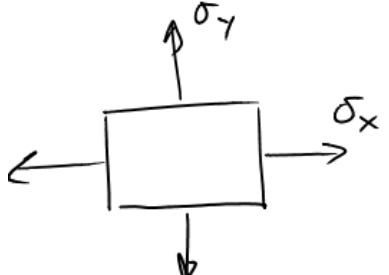
$\sigma_y = \tau_{xy} = 0$
 $\sigma_{x_1} = \frac{\sigma_x}{2} + \frac{\sigma_x}{2} \cos 2\theta$
 $\sigma_{x_1} = \frac{\sigma_x}{2} (1 + \cos 2\theta)$

Max at $\theta = 0$
 $\sigma_{x_1} = \sigma_x$



$\sigma_x = \sigma_y = 0$
 $\tau_{x_1y_1} = \tau_{xy} \cos 2\theta$
 Max at $\theta = 0^\circ$

$\tau_{x_1y_1} = \tau_{xy}$
 $\tau_{xy} = 0$



$\sigma_{x_1} = \frac{\sigma_x + \sigma_y}{2} + \frac{\sigma_x - \sigma_y}{2} \cos 2\theta$