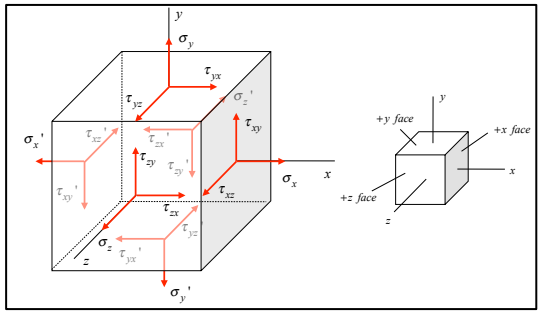
Lecture 5 summary: general state of stress

- *STRESS COMPONENTS*: There are only six unique components of stress: $\sigma_x, \sigma_x, \sigma_x, \tau_{xy}, \tau_{xz}, \tau_{yz}$

  (*see lecture book for sign conventions*)



- *STRESS/STRAIN RELATIONS* (Hooke's law for linear behavior):

thermal strains

$$\varepsilon_x = \frac{1}{E}\left[\sigma_x - \nu\left(\sigma_y + \sigma_z\right)\right] + \alpha\Delta T$$

$$\varepsilon_y = \frac{1}{E}\left[\sigma_y - \nu\left(\sigma_x + \sigma_z\right)\right] + \alpha\Delta T$$

$$\varepsilon_z = \frac{1}{E}\left[\sigma_z - \nu\left(\sigma_x + \sigma_y\right)\right] + \alpha\Delta T$$

$$\gamma_{xy} = \tau_{xy} / G \quad ; \quad \gamma_{xz} = \tau_{xz} / G \quad ; \quad \gamma_{yz} = \tau_{yz} / G$$

where E = Young's modulus, G = shear modulus, ν = Poisson's ratio and α = thermal expansion coefficient.

- *NOTE!* For general loadings, remember that: $\sigma \neq E\varepsilon$. Also, it is possible to have *non-zero strains with zero stress*. And, vice versa.