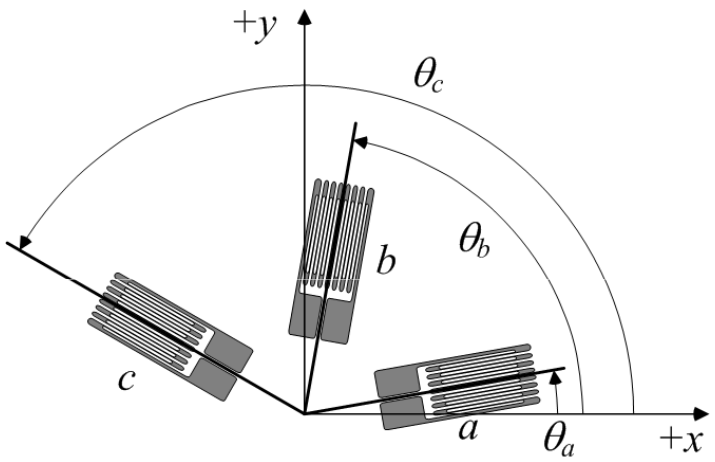
General Rosette Equations



- Denote measured strains as ε_a, ε_b, and ε_c:

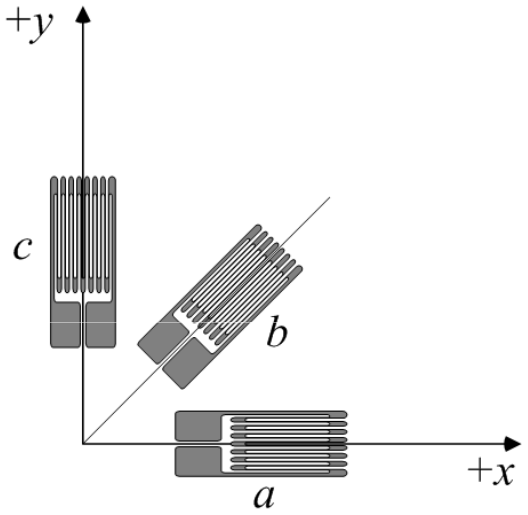
- Use strain transformation equation to relate each gage measurement to ε_{xx}, ε_{yy}, and γ_{xy}:

$$\varepsilon_a = \varepsilon_{xx}\cos^2\theta_a + \varepsilon_{yy}\sin^2\theta_a + \gamma_{xy}\sin\theta_a\cos\theta_a$$

$$\varepsilon_b = \varepsilon_{xx}\cos^2\theta_b + \varepsilon_{yy}\sin^2\theta_b + \gamma_{xy}\sin\theta_b\cos\theta_b$$

$$\varepsilon_c = \varepsilon_{xx}\cos^2\theta_c + \varepsilon_{yy}\sin^2\theta_c + \gamma_{xy}\sin\theta_c\cos\theta_c$$

Rosette Equations for Rectangular Rosettes



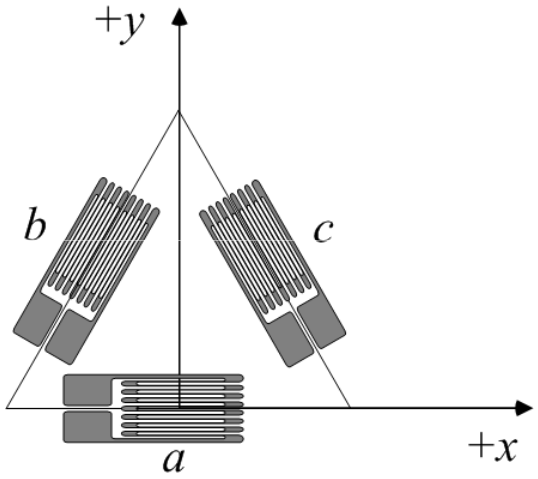
• Substituting:

$$\theta_a = 0^o$$
$$\theta_b = 45^o$$
$$\theta_c = 90^o$$

in general rosette equations and inverting, we obtain:

$$\varepsilon_{xx} = \varepsilon_a$$
$$\varepsilon_{yy} = \varepsilon_c$$
$$\gamma_{xy} = 2\varepsilon_b - (\varepsilon_a + \varepsilon_c)$$

Rosette Equations for Delta Rosettes



• Substituting:

$$\theta_a = 0^o$$
$$\theta_b = 60^o$$
$$\theta_c = 120^o$$

in general rosette equations and inverting, we obtain:

$$\varepsilon_{xx} = \varepsilon_a$$

$$\varepsilon_{yy} = \frac{1}{3}\left[2\left(\varepsilon_b + \varepsilon_c\right) - \varepsilon_a\right]$$

$$\gamma_{xy} = \frac{2}{\sqrt{3}}\left[\varepsilon_b - \varepsilon_c\right]$$