$$T^2 = \sigma_n^2 + \tau_s^2$$

Stress matrix.

Normal vector

Traction vector.

Normal stress

Shear stress.

$$\sigma = \begin{bmatrix} 1 & 1 & -1 \\ 1 & 2 & 1 \\ -1 & 1 & 3 \end{bmatrix}$$

$$l = \frac{1}{\sqrt{3}}, m = \frac{1}{\sqrt{3}}, n = \frac{1}{\sqrt{3}}$$

$$n = \begin{Bmatrix} \frac{1}{\sqrt{3}} \\ \frac{1}{\sqrt{3}} \\ \frac{1}{\sqrt{3}} \end{Bmatrix}$$

$$\{T\} = \begin{Bmatrix} T_x \\ T_Y \\ T_z \end{Bmatrix} = [\sigma]\{n\}$$

$$\{T\} = \begin{bmatrix} 1 & 1 & -1 \\ 1 & 2 & 1 \\ -1 & 1 & 3 \end{bmatrix} \begin{Bmatrix} \frac{1}{\sqrt{3}} \\ \frac{1}{\sqrt{3}} \\ \frac{1}{\sqrt{3}} \end{Bmatrix}$$

$$\{T\} = \begin{Bmatrix} 1\,x\frac{1}{\sqrt{3}} + 1x\frac{1}{\sqrt{3}} - 1x\frac{1}{\sqrt{3}} \\ 1\,x\frac{1}{\sqrt{3}} + 2x\frac{1}{\sqrt{3}} + 1x\frac{1}{\sqrt{3}} \\ -1\,x\frac{1}{\sqrt{3}} + 1x\frac{1}{\sqrt{3}} + 3x\frac{1}{\sqrt{3}} \end{Bmatrix} = \begin{Bmatrix} \frac{1}{\sqrt{3}} \\ \frac{4}{\sqrt{3}} \\ \frac{3}{\sqrt{3}} \end{Bmatrix}$$

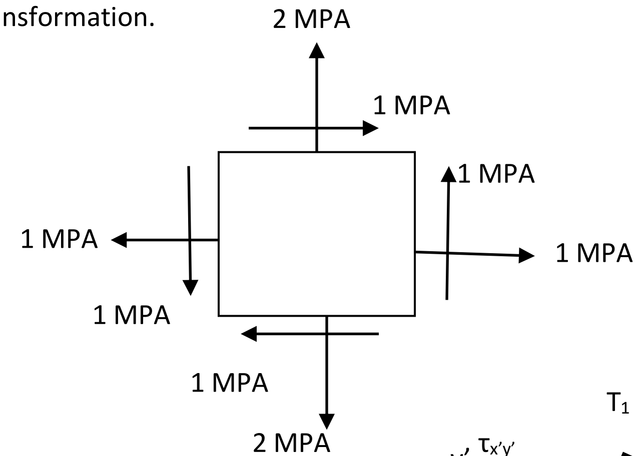
$$\vec{T} = \frac{1}{\sqrt{3}}\hat{\imath} + \frac{4}{\sqrt{3}}\hat{\jmath} + \frac{3}{\sqrt{3}}\hat{k}$$

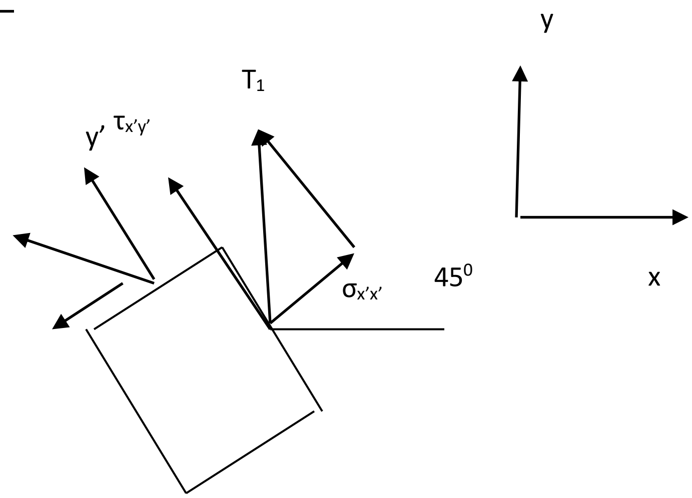
$$\vec{n} = \frac{1}{\sqrt{3}}\hat{\imath} + \frac{1}{\sqrt{3}}\,\hat{\jmath} + \frac{1}{\sqrt{3}}\hat{k}$$

$$\sigma_n = \vec{T}\,.\,\vec{n} = \tfrac{1}{3} + \tfrac{4}{3} + \tfrac{3}{3} = 8\,/3 \text{ MPa}$$

$$\left(\frac{26}{3}\right)^2 = \left(\frac{8}{3}\right)^2 + \tau_s^2$$

3D-stress transformation.





$$\sigma = \begin{bmatrix} 1 & 1 \\ 1 & 2 \end{bmatrix}$$

$$\{X'\} = \begin{Bmatrix} \cos(45\ degree) \\ \sin(45\ degree\_ \end{Bmatrix}$$

$$\{Y'\} = \begin{Bmatrix} \cos(135\ degree) \\ \sin(135\ degree) \end{Bmatrix}$$

$$T = \begin{bmatrix} 1 & 1 \\ 1 & 2 \end{bmatrix} \begin{Bmatrix} \cos(45\ degree) \\ \sin(45\ degree) \end{Bmatrix} = \begin{Bmatrix} \frac{2}{\sqrt{2}} \\ \frac{3}{\sqrt{2}} \end{Bmatrix}$$

$$\vec{T} = \frac{2}{\sqrt{2}}\hat{\imath} + \frac{3}{\sqrt{2}}\,\hat{\jmath} + 0\,\hat{k}$$

$$\sigma_{x'x'} = \vec{T}\,.\,X'$$

$$\tau_{x'y'} = \vec{\vec{T}} \, . Y'$$

$$\tau_{x'z'} = \vec{\vec{T}} \, . Z'$$