

Mohr's Circle

Mechanical Engineering

Turning a stress state into principal stresses by drawing one circle.

Plane stress. Angles on the circle are twice the angles on the element.

1 Plot the two face points

Plot (σ_x, τ_{xy}) and $(\sigma_y, \text{minus } \tau_{xy})$ on normal and shear axes.

2 Join them

The line crosses the normal-stress axis at the centre of the circle.

3 Read the centre

Centre = $(\sigma_x + \sigma_y) \div 2$. Rotation never moves it.

4 Read the radius

$R = \sqrt{(\text{half the stress difference squared, plus } \tau_{xy} \text{ squared})}$.

5 Take off the answers

Principal stresses are centre $\pm R$; maximum shear is R itself.

The sum of the two normal stresses is invariant under rotation. That is the check on your centre.