

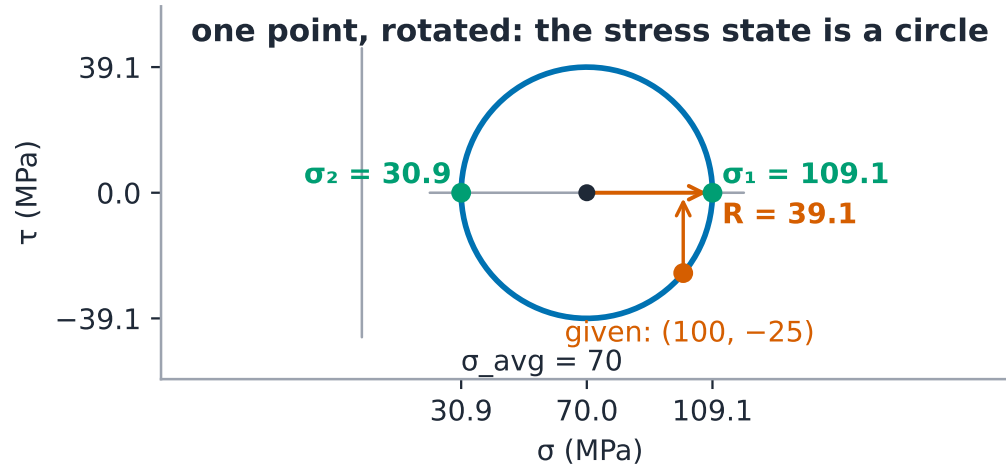
Exercise walk-through

6.5

Combined stress and Mohr's circle

University Mechanical Engineering

Combined stress and Mohr's circle



Point (100, 40, 25) MPa: centre 70, $R = 39.1$, so $\sigma_1 = 109.1$, $\sigma_2 = 30.9$ MPa at 19.9° . With the second stress at -40 : $R = 85.4$, $\sigma_1 = 125.4$, $\sigma_2 = -45.4$ MPa.

Exercises 2.1·2.2

2.1 A point carries $\sigma_x = 80$, $\sigma_y = 20$ and $\tau_{xy} = 30$ MPa: the circle centre (MPa) and the radius (one decimal, MPa). [4]

2.2 The two principal stresses (one decimal each, MPa) and the principal angle from the x-face (one decimal, degrees). [4]

Exercises 2.1-2.2

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2.1

- $\sigma_{avg} = (80 + 20)/2 = \mathbf{50.0}$ MPa.
- $R = \sqrt{30^2 + 30^2} = \sqrt{1800} = \mathbf{42.4}$ MPa.

2.2 The two principal stresses (one decimal each, MPa) and the principal angle from the x-face (one decimal, degrees). [4]

2.2

- $\sigma_1 = 50 + 42.4 = \mathbf{92.4}$ MPa.
- $\sigma_2 = 50 - 42.4 = \mathbf{7.6}$ MPa.
- $\theta_p = \tan^{-1}(2 \times 30/60)/2 = 45/2 = \mathbf{22.5^\circ}$.

Exercises 2.3-2.4

2.3 The absolute-maximum shear stress at the point (one decimal, MPa), with the reason. [3]

2.4 If the second normal stress were -20 MPa instead (all else equal): what changes about the maximum shear, and what is its new value (one decimal, MPa)? [3]

Exercises 2.3-2.4

2.3 The absolute-maximum shear stress at the point (one decimal, MPa), with the reason. [3]

2.3

- Both principals positive, so the absolute-maximum shear is $\sigma_1/2 = \mathbf{46.2}$ MPa.

2.4 If the second normal stress were -20 MPa instead (all else equal): what changes about the maximum shear, and what is its new value (one decimal, MPa)? [3]

2.4

- The principals would straddle zero, so the absolute-maximum shear becomes the in-plane radius itself.
- $R' = \sqrt{50^2 + 30^2} = \sqrt{3400} = \mathbf{58.3}$ MPa.