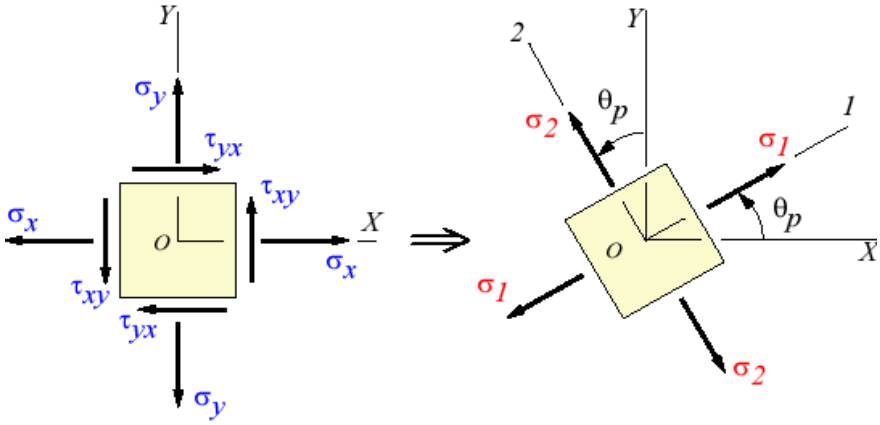
Calculator Introduction

Given the stress components s_x, s_y, and t_{xy}, this calculator computes the principal stresses s_1, s_2, the principal angle q_p, the maximum shear stress t_{max} and its angle q_s. It also draws an approximate Mohr's cirlce for the given stress state.



Stresses in given coordinate system

Principal stresses

Inputs

Normal Stress s_x: 1 MPa

Normal Stress s_y: 0.1

Shear Stress t_{xy}: 1

Answers

Maximum Normal Stress s_1: 1.65 MPa

Minimum Normal Stress s_2: -0.547 MPa

Principal Angle q_p: 32.9 deg

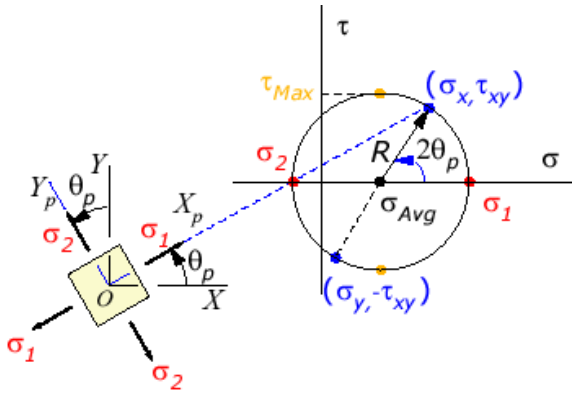
Maximum Shear Stress t_{max}: 1.10 MPa

Maximum Shear Angle q_{s1}: 77.9 deg

and q_{s2}: -12.1 deg

Calculate Again Default Values

The Mohr's circle associated with the above stress state is similar to the following figure. However, the exact loaction of the center s_{Avg}, the radius of the Mohr's circle R, and the principal angle q_p may be different from what are shown in the figure.



Equations behind the Calculator

The formulas used in this calculator are,

$$\tan 2\theta_p = \frac{2\tau_{xy}}{}$$

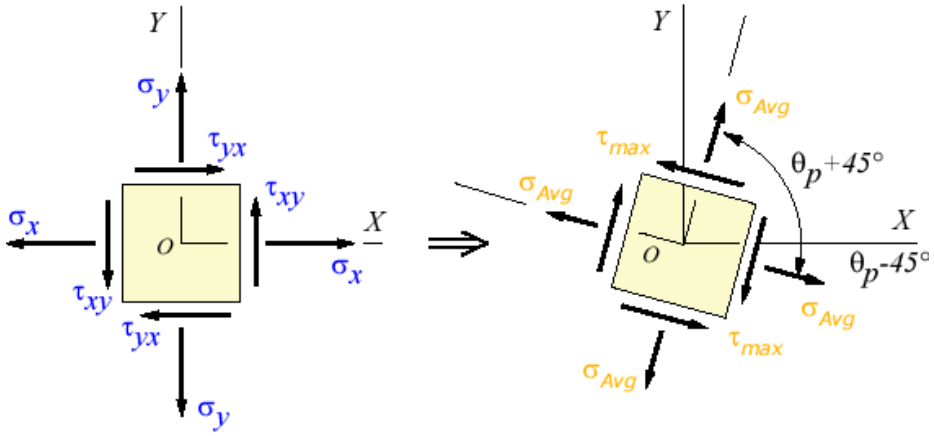
$$\sigma_x - \sigma_y$$

$$\sigma_{1,2} = \frac{\sigma_x + \sigma_y}{2} \pm \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + {\tau_{xy}}^2}$$

$$\tau_{max} = \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + {\tau_{xy}}^2} = \frac{\sigma_1 - \sigma_2}{2}$$

$$\tan 2\theta_s = -\frac{\sigma_x - \sigma_y}{2\tau_{xy}}$$

$$\Rightarrow \theta_s = \theta_p \pm 45^\circ$$



Stresses in given coordinate system

Maximum shear stress

Further information can be found in the plane stress, Mohr's Circle, and the Mohr's Circle usage pages.