Circle of Mohr - from NASTRAN to Stress Analysis

$N_x := 1000 \cdot \frac{lbf}{in}$ $N_y := -1000 \cdot \frac{lbf}{in}$ $N_{xy} := 500 \cdot \frac{lbf}{in}$ $t := 3 \cdot mm$

$\sigma_x := \frac{N_x}{t} = 58 \cdot MPa$ $\sigma_y := \frac{N_y}{t} = -58 \cdot MPa$ $\tau_{xy} := \frac{N_{xy}}{t} = 29 \cdot MPa$

$E := 70000 \cdot MPa$ $\nu := 0.33$ $G_{xy} := \frac{E}{2 \cdot (1+\nu)} = 26316 \cdot MPa$

$$R_{stress} := \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2} = 65 \cdot MPa$$

$$X_{stress} := \frac{\sigma_x + \sigma_y}{2}$$

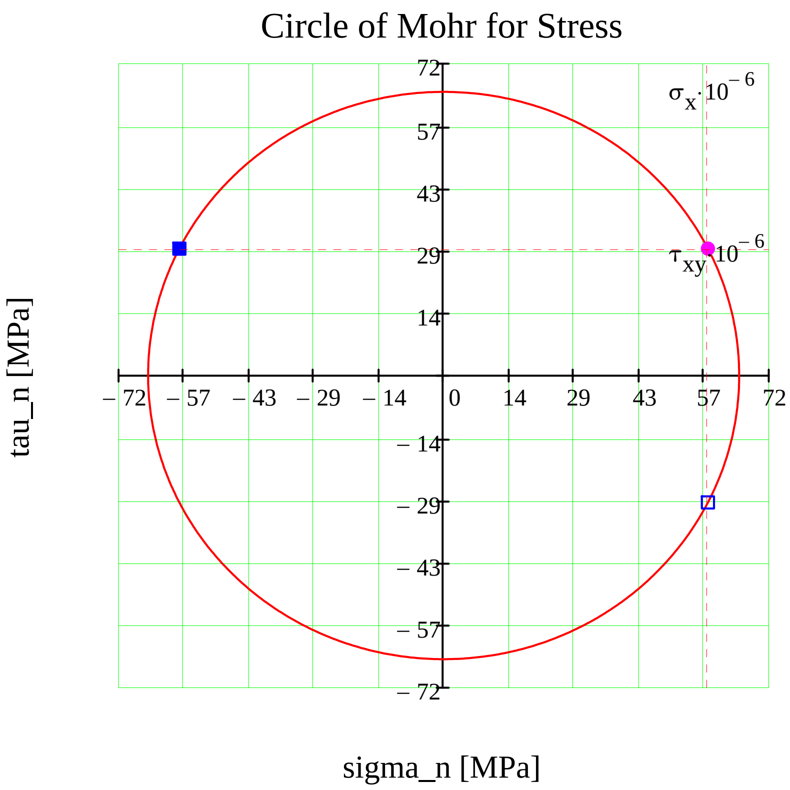
$Y_{stress} := 0 \cdot MPa$

$x(\alpha) := X_{stress} + R_{stress} \cdot \cos(\alpha)$ $y(\alpha) := Y_{stress} + R_{stress} \cdot \sin(\alpha)$

$theta := 0, 0.01 .. 2 \cdot \pi$

$Xmin := x(180 \cdot deg) \cdot 1.1 = -72 \cdot MPa$ $Xmax := x(0 \cdot deg) \cdot 1.1 = 72 \cdot MPa$

$Ymin := y(270 \cdot deg) \cdot 1.1 = -72 \cdot MPa$ $Ymax := y(90 \cdot deg) \cdot 1.1 = 72 \cdot MPa$



$$\sigma_n(\alpha) := \frac{\sigma_x + \sigma_y}{2} + \frac{\sigma_x - \sigma_y}{2}\cdot\cos(2\cdot\alpha) + \tau_{xy}\cdot\sin(2\cdot\alpha)$$

$$\sigma_n(13.283\cdot deg) = 65\cdot MPa$$

$$\tau_n(\alpha) := -\frac{\sigma_x - \sigma_y}{2}\cdot\sin(2\cdot\alpha) + \tau_{xy}\cdot\cos(2\cdot\alpha)$$

$$\tau_n(13.283\cdot deg) = -0\cdot MPa$$

$$\theta_p := \frac{1}{2}\cdot atan\left(\frac{2\cdot\tau_{xy}}{\sigma_x - \sigma_y}\right) = 13.3\cdot deg$$

$$\sigma_1 := \frac{\sigma_x + \sigma_y}{2} + \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^{\ 2}} = 65\cdot MPa$$

$$\sigma_2 := \frac{\sigma_x + \sigma_y}{2} - \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^{\ 2}} = -65\cdot MPa$$