Mohr Circle

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Definition

A graphical representation of normal stresses and shear stresses was developed by Professor Otto Mohr (1835–1918) who recognized that the equations could be rearranged into the form describing a circle:

$$\left[\sigma_\beta - \left(\frac{\sigma_x + \sigma_y}{2} \right) \right]^2 + [\tau_\beta - 0]^2 = \left[\sqrt{\left(\frac{\sigma_x - \sigma_y}{2} \right)^2 + \tau_x^2} \right]^2 \quad (1)$$

where the second part of the right-hand term is the x coordinate of the circle center, the second part of the middle term is the y coordinate of the circle center, and the term inside the right-hand bracket is the circle radius. The Mohr circle graph contains three circles in a plane stress example: $\sigma_2 = 0$. A similar graph showing three-dimensional information would have two additional circles inset into each of the three circles shown that intersect the normal stress x axis at the value of σ_2 with diameters equal to $(\sigma_1 - \sigma_3)$ (shown),

$(\sigma_1 - \sigma_2)$, and $(\sigma_2 - \sigma_3)$. The smaller circles that intersect the origin are uniaxial compression and uniaxial tension. The dot-dash lines that are tangent to the circles denote the Mohr-Coulomb failure envelope; ϕ is the angle of internal friction. The inset graph displays positions of Plane x , Plane y , and Plane β in the largest Mohr stress circle. A similar construction can be made to show the Mohr strain circle.