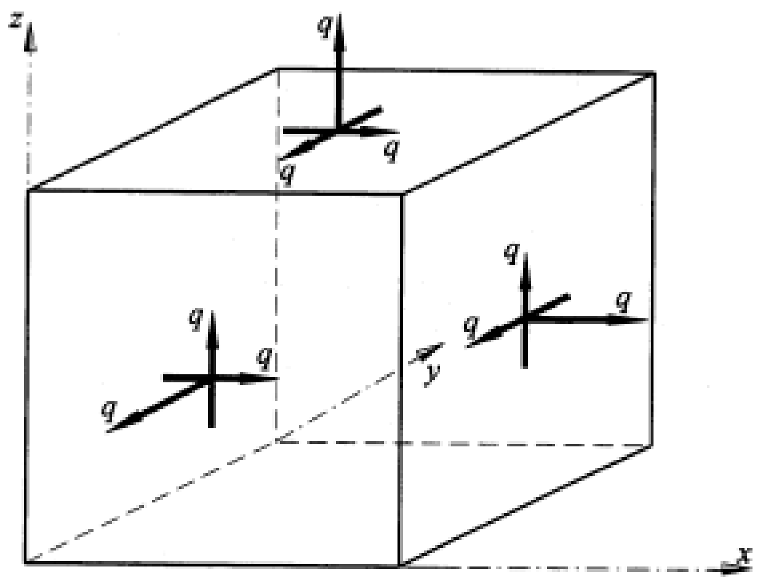


Gegeven

Vloeien treedt op bij een wringspanning van 120 Mpa

Gevraagd

a) Bepaal analytisch, uitgaande van het vloeicriterium van Tresca, bij welke waarde van q het materiaal zal gaan vloeien
b) Doe dit zelfde op basis van het Von Mises vloeicriterium

SPANNINGSTENSOR

$$\sigma_{ij} = \begin{bmatrix} q & -q & q \\ -q & q & -q \\ q & -q & q \end{bmatrix}$$

OPLOSSEN:

$$\sigma^3 - 3q\sigma^2 = 0$$

$$dus:$$

$$\sigma_3 = 0 \quad \sigma_2 = 0 \quad \sigma_1 = 3q$$

HOOFDSPANNINGEN

$$\sigma^3 - I_1\sigma^2 + I_2\sigma - I_3 = 0$$

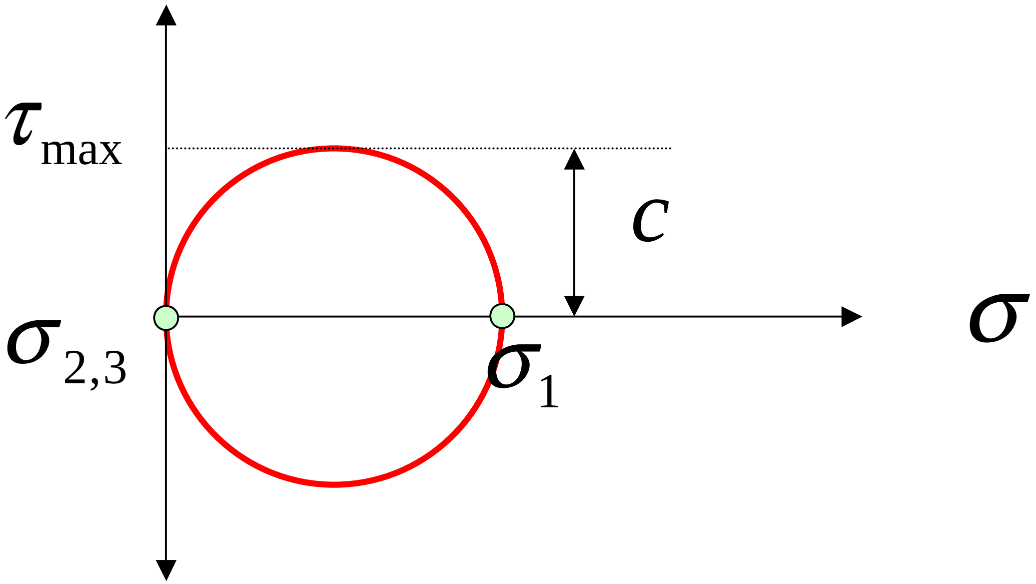
$$met:$$

$$I_1 = \sigma_{xx} + \sigma_{yy} + \sigma_{zz}$$

$$I_2 = \sigma_{xx}\sigma_{yy} + \sigma_{yy}\sigma_{zz} + \sigma_{zz}\sigma_{xx} - \sigma_{xy}^2 - \sigma_{yz}^2 - \sigma_{zx}^2$$

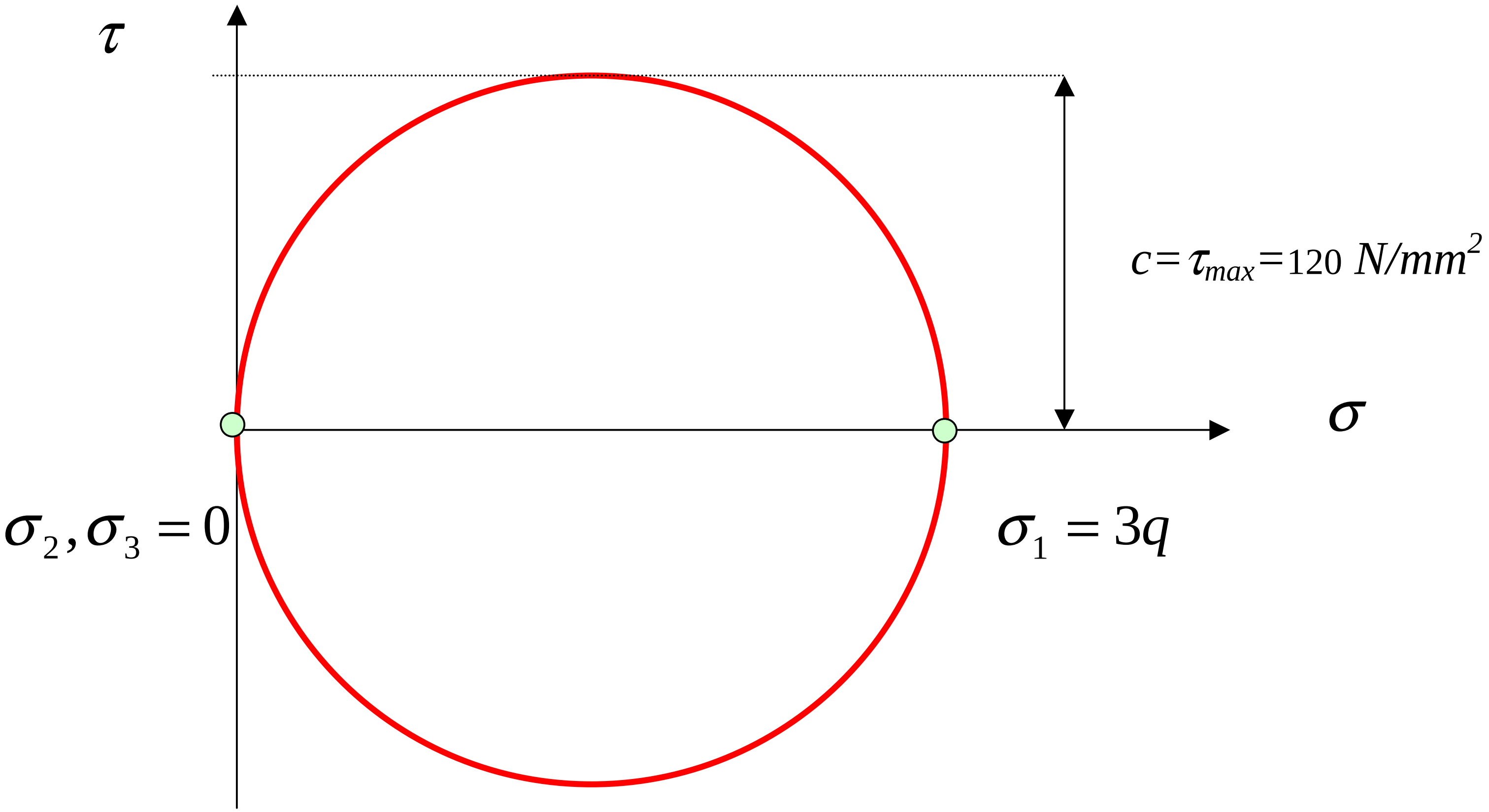
$$I_3 = \sigma_{xx}\sigma_{yy}\sigma_{zz} - \sigma_{xx}\sigma_{yz}^2 - \sigma_{yy}\sigma_{zx}^2 - \sigma_{zz}\sigma_{xy}^2 + 2\sigma_{xy}\sigma_{yz}\sigma_{zx}$$

MAXIMALE WRINGSPANNING = SCHUIFSPANNING=120 N/mm^2



C=120 N/mm^2

CIRKEL VAN MOHR



TRESCA Maatgevend criterium:

$$\left|\sigma_1-\sigma_2\right|\le 2c=f_y \quad \Rightarrow \quad \left|\sigma_1-\sigma_2\right|=3q\le 240$$
$$\left|\sigma_2-\sigma_3\right|\le 2c=f_y \quad \Rightarrow \quad \left|\sigma_2-\sigma_3\right|=0\le 240$$
$$\left|\sigma_3-\sigma_1\right|\le 2c=f_y \quad \Rightarrow \quad \left|\sigma_3-\sigma_1\right|=3q\le 240 \quad dus: \quad q\le 80\ N/mm^2$$

VON MISES Maatgevend criterium:

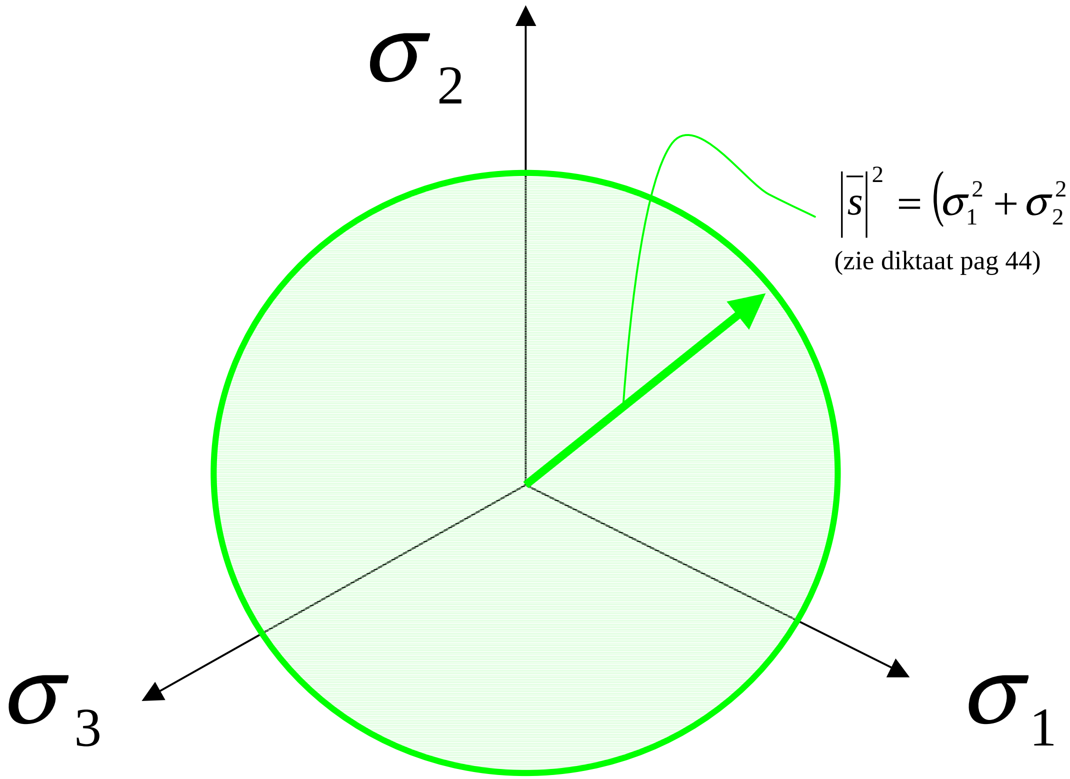
$$\frac{1}{6}\left\{(\sigma_1-\sigma_2)^2+(\sigma_2-\sigma_3)^2+(\sigma_3-\sigma_1)^2\right\}-\tfrac{1}{3}f_y^2\le 0$$

$$invullen:$$

$$\tfrac{1}{6}\left\{0^2+9q^2+9q^2\right\}-\tfrac{1}{3}*240^2\le 0$$

$$q\le 80\ N/mm^2$$

MAXIMUM STELLEN AAN DE DEVIATORSPANNING



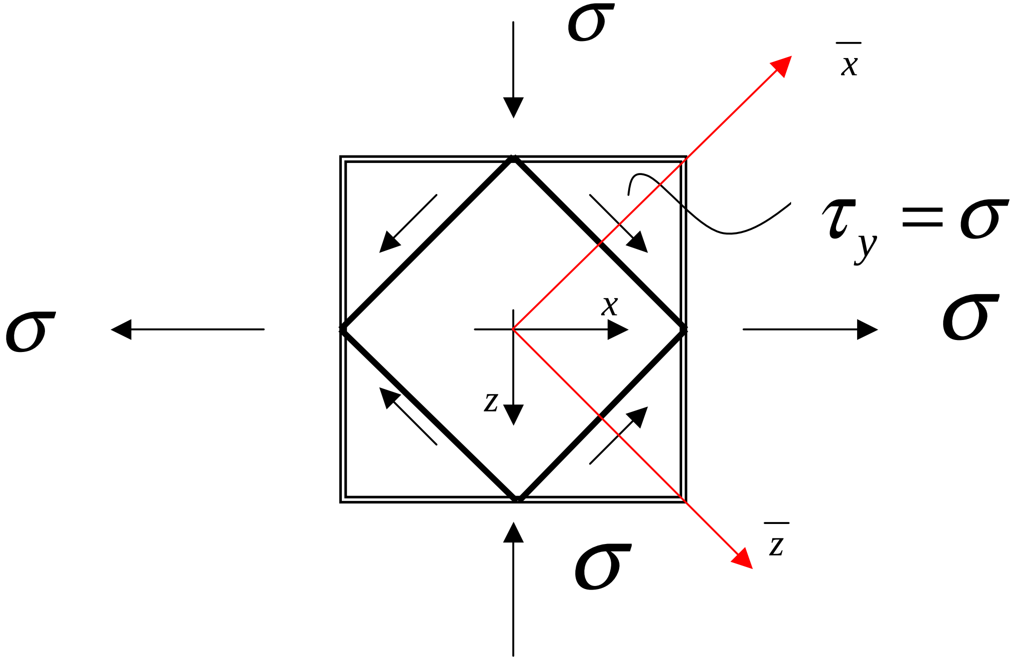
$$|\bar{s}|^2 = \left(\sigma_1^2 + \sigma_2^2 + \sigma_3^2\right) - 3\sigma_0^2$$

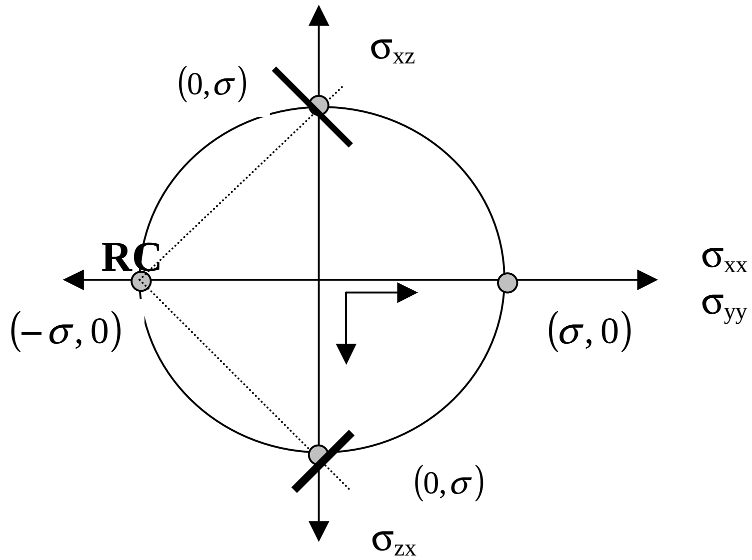
(zie diktaat pag 44)

$$|\bar{s}| \leq s_{\max}$$

$$|\bar{s}|^2 = \tfrac{1}{3}\left[(\sigma_1 - \sigma_2)^2 + (\sigma_2 - \sigma_3)^2 + (\sigma_3 - \sigma_1)^2\right] \leq s_{\max}^2$$

MAXIMALE DEVIATORSPANNING OP BASIS VAN AFSCHUIFPROEF





$$\sigma_1 = \tau_y \quad \sigma_2 = -\tau_y \quad \sigma_3 = 0$$

$$invullen:$$

$$\tfrac{1}{3}\left(4\tau_y{}^2 + \tau_y{}^2 + \tau_y{}^2\right) \le s^2_{max} \quad \Rightarrow \quad s^2_{max} = 2\tau_y^2$$

VON MISES (OP BASIS VAN AFSCHUIFPROEF)

$$\tfrac{1}{6}\left[(\sigma_1-\sigma_2)^2+(\sigma_2-\sigma_3)^2+(\sigma_3-\sigma_1)^2\right]-\tau_y^2\leq 0$$

met :

$$\tau_y = 120\ N/mm^2$$

PAS DIT TOE OP DIT VOORBEELD:

$$\frac{1}{6}\left[9q^2+9q^2\right]-120^2=0$$

$$q = 69{,}3\ N/mm^2$$

SAMENVATTEND

VON MISES :

$$\tfrac{1}{6}\left[(\sigma_1-\sigma_2)^2+(\sigma_2-\sigma_3)^2+(\sigma_3-\sigma_1)^2\right]-k^2\leq 0$$

$$\textit{trekproef}\ :$$

$$k^2=\tfrac{1}{3}f_y^2$$

$$\textit{afschuifproef}\ :$$

$$k^2=\tau_y^2$$

TRESCA :

$$|\sigma_1-\sigma_2|\leq 2c \qquad \textit{trekproef}\ : \quad c=\tfrac{1}{2}f_y$$

$$|\sigma_2-\sigma_3|\leq 2c \qquad \textit{afschuifproef}\ : \quad c=\tau_y$$

$$|\sigma_3-\sigma_1|\leq 2c$$

TRESCA VERSUS VON MISES