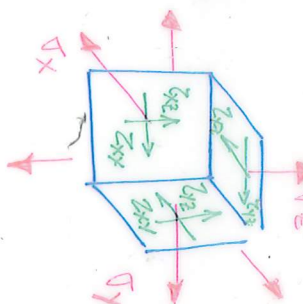
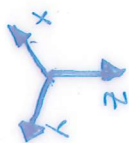


92 SPÄNNINGAR i 3D/2D

* Spänningsmatrisen beskriver spänningarna i en punkt

$$[F.S.(1.3)]$$

$$\underline{\underline{S}} = \begin{bmatrix} \sigma_x & \tau_{xy} & \tau_{xz} \\ \tau_{yx} & \sigma_y & \tau_{yz} \\ \tau_{zx} & \tau_{zy} & \sigma_z \end{bmatrix}$$



$$\underline{\underline{S}} = \underline{\underline{S}}^T \text{ sym.}$$

* Normalspänningen och skjuvspänningen beskriver

spänningsvektorn på en snittyta.

[F.S.(1.5)] • Spänningsvektor:

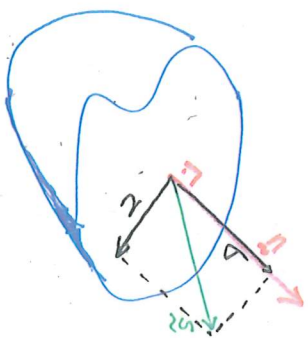
$$\underline{\underline{s}} = \underline{\underline{S}}^T \underline{\underline{n}}$$

Normalspänning:

$$\sigma = \underline{\underline{n}}^T \underline{\underline{s}} \underline{\underline{n}}$$

Skjuvspänning:

$$\tau = (|\underline{\underline{s}}|^2 - \sigma^2)^{1/2}$$



* Huvudspänningar 3D. [F.S. 1.11-14]

$$\det(\underline{\underline{S}} - \sigma \underline{\underline{I}}) = 0 \rightarrow \sigma_i \Rightarrow \sigma_1 \geq \sigma_2 \geq \sigma_3$$

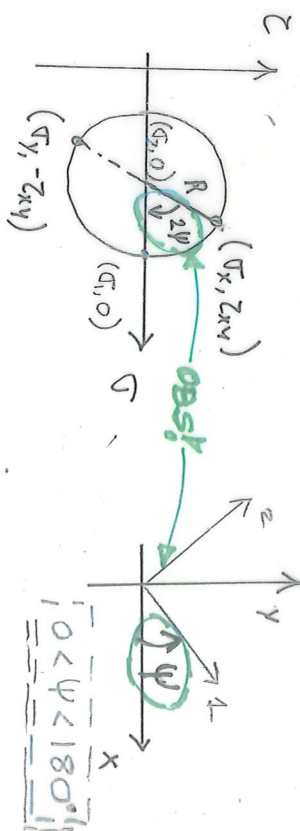
Huvudspänningar

$$(\underline{\underline{S}} - \sigma \underline{\underline{I}}) \underline{\underline{n}} = 0 \rightarrow \underline{\underline{n}}: \text{huvudspänningsriktningar}$$

* Huvudspänningar 2D

(vid plan vinkelrätt mot huvudspänningsriktning $\underline{\underline{n}}_3$)

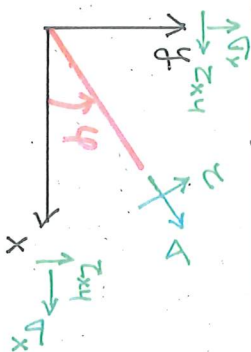
Mohrs spänningscirkel [F.S.(1.14) s.7]



$$\sigma_{1,2} = \frac{1}{2} (\sigma_x + \sigma_y) \pm R ; \quad R = \left[\left(\frac{\sigma_x - \sigma_y}{2} \right)^2 + \tau_{xy}^2 \right]^{1/2}$$

$$\tan 2\psi = \frac{2\tau_{xy}}{\sigma_x - \sigma_y} + \text{m.h.d. Mohr's circle}$$

* Rotation av koordinatsystemet i 2D [F.S. 1.5 s6]



$$\sigma(\psi) = \sigma_x \cos^2 \psi + \sigma_y \sin^2 \psi + 2\tau_{xy} \sin \psi \cos \psi$$

$$\tau(\psi) = \frac{\sigma_y - \sigma_x}{2} \sin 2\psi + \tau_{xy} \cos 2\psi$$