

# TÖJNING 3D

## Ö13-15 SPÄNNINGAR OCH TÖJNINGAR VID SAMMANSATT BELASTNING

HOOKES LAG [F.S. s. 22-23] linjärt termelastiskt medt.

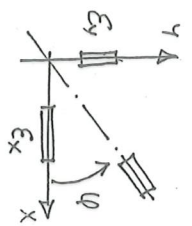
$$\epsilon_x = \frac{1}{E} (\sigma_x - \nu (\sigma_y + \sigma_z)) + \alpha \Delta T; \quad \gamma_{xy} = \frac{1}{G} \tau_{xy}$$

$$\epsilon_y = \frac{1}{E} (\sigma_y - \nu (\sigma_z + \sigma_x)) + \alpha \Delta T; \quad \gamma_{yz} = \frac{1}{G} \tau_{yz}$$

$$\epsilon_z = \frac{1}{E} (\sigma_z - \nu (\sigma_x + \sigma_y)) + \alpha \Delta T; \quad \gamma_{zx} = \frac{1}{G} \tau_{zx}$$

DEFORMATIONER I EFT PLAN (i huvudsättningssriktning)

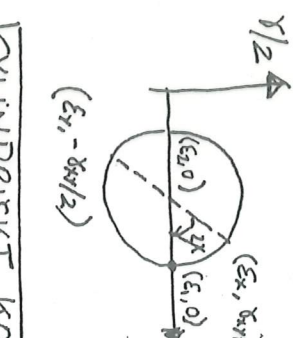
[F.S. s. 18-19]



$$\epsilon(\varphi) = \epsilon_x \cos^2 \varphi + \epsilon_y \sin^2 \varphi + \gamma_{xy} \sin 2\varphi$$

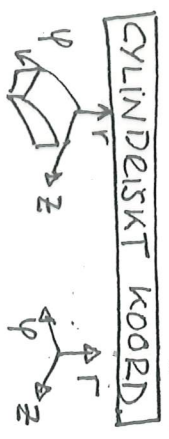
$$\gamma(\varphi) = (\epsilon_y - \epsilon_x) \sin 2\varphi + \gamma_{xy} \cos 2\varphi$$

MOHRS TÖJNINGSCIRKEL [F.S. s. 18-19]



$$\epsilon_{1,2} = \frac{1}{2} (\epsilon_x + \epsilon_y) \pm \sqrt{\left(\frac{\epsilon_x - \epsilon_y}{2}\right)^2 + \left(\frac{\gamma_{xy}}{2}\right)^2}$$

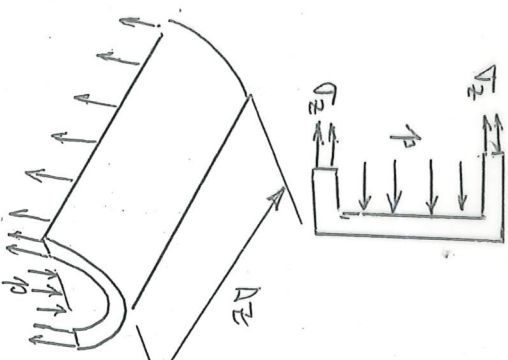
$$\sin 2\chi = \frac{\gamma_{xy}}{2R} \quad \cos 2\chi = \frac{\epsilon_x - \epsilon_y}{2R}$$



\* SPÄNNINGAR P.G.A. ÖVERTRYCK.

TUNNVÄGGIGA RÖR

[grova boken s. 177-8]



$$\rightarrow -p \pi r^2 + \sigma_z 2 \pi r h = 0$$

$$\sigma_z = \frac{pr}{2h}$$

$$\tau_\varphi = \frac{p r}{h}$$

TJOCKVÄGGIGA RÖR [F.S. s. 93]

med konstant temp.

$$\tau_r = A - \frac{B}{r^2}, \quad \sigma_z = k$$

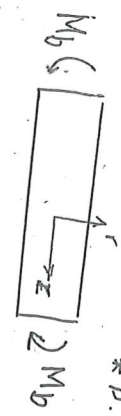
$$\tau_\varphi = A + \frac{B}{r^2}$$

BÖJ / VRIDNING I TJOCK/TUNNVÄGGIGA RÖR



$$\sigma_z = \frac{M_y}{I} r \sin \varphi$$

$$\tau_{\max} = \frac{M_y}{I} r_{\max} = \frac{M_y}{I} r$$



$$\sigma_z = \frac{M_b}{I} r \sin \varphi$$

