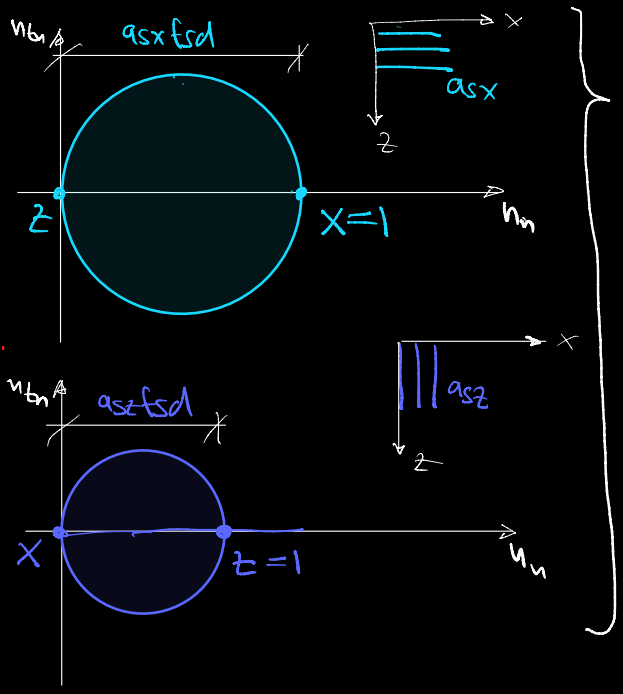
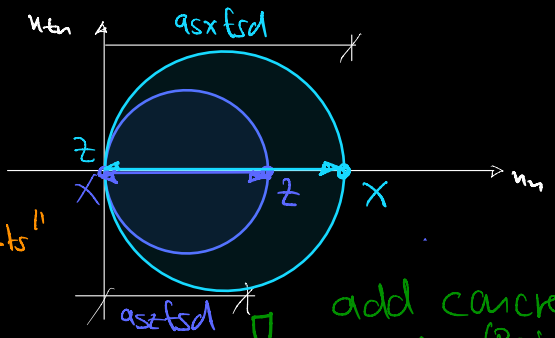
Membrane elements – skew reinforcement

each reinforcement direction =
= uniaxial tension (+compressi-) field
in its direction

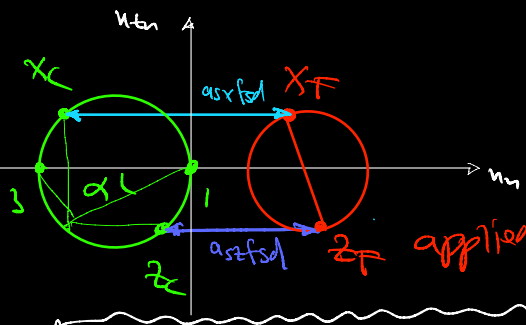
· orthogonal reinforcement:



"combine reinforcements"

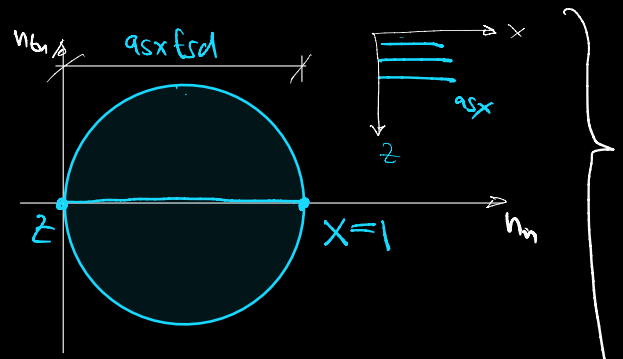


add concrete $\sigma_{c3} \leq f_{cd}$! (Resinel)

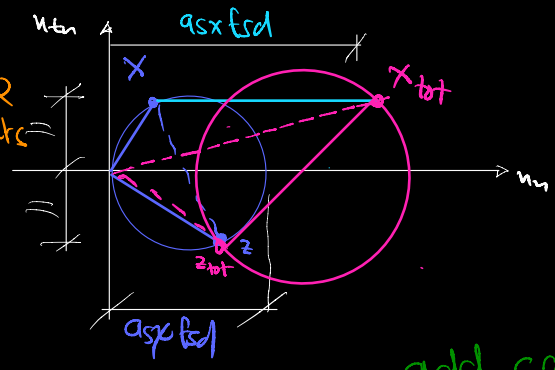


$$n_{xu} = a_{sx} f_{sd} \geq n_x + \cot\alpha \cdot |n_{xz}|$$
$$n_{zu} = a_{sz} f_{sd} \geq n_z + \tan\alpha \cdot |n_{xz}|$$

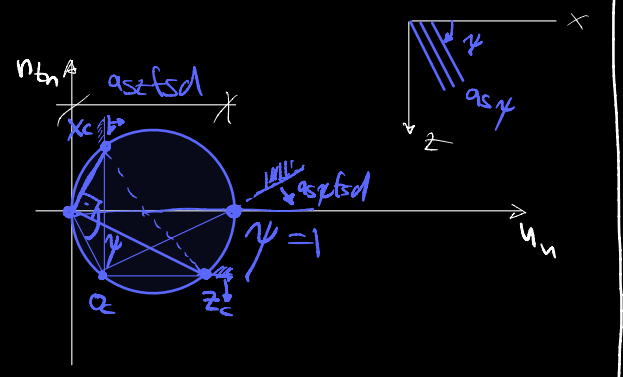
· Skew reinforcement

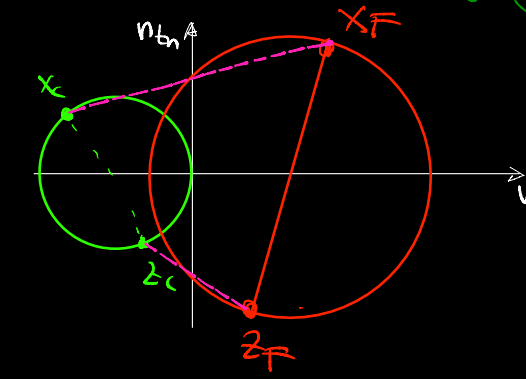


combine reinforcements



add concrete ! (Resinel)



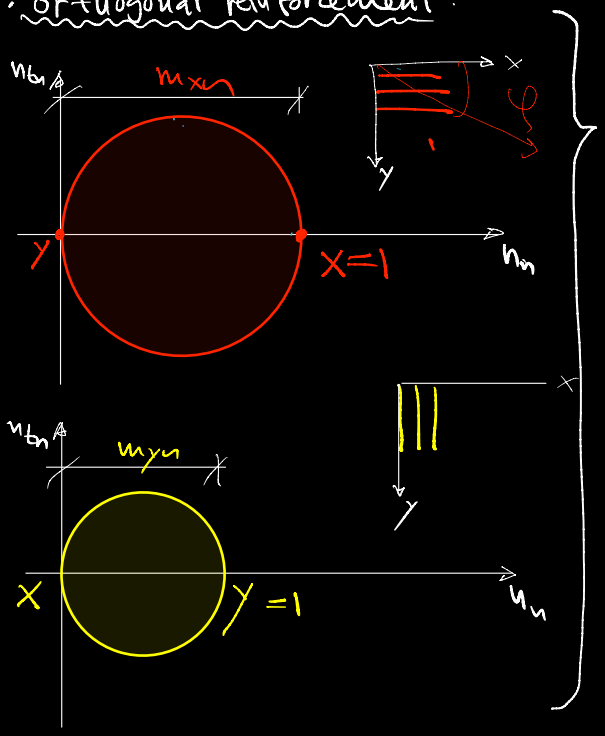


Reinf. concrete slabs – skew reinforcement

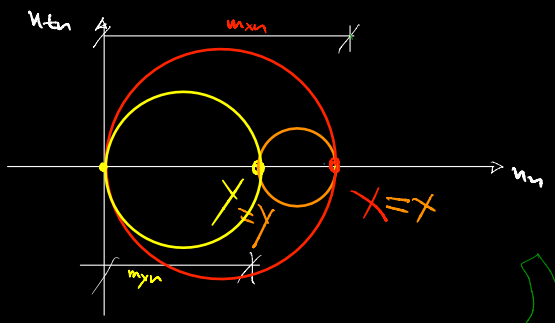
each reinforcement direction = uniaxial tension (+compressi-) field in its direction

$m_{nn} \le m_n \; \forall \varphi$ (≠ add concrete; no "Regime I")

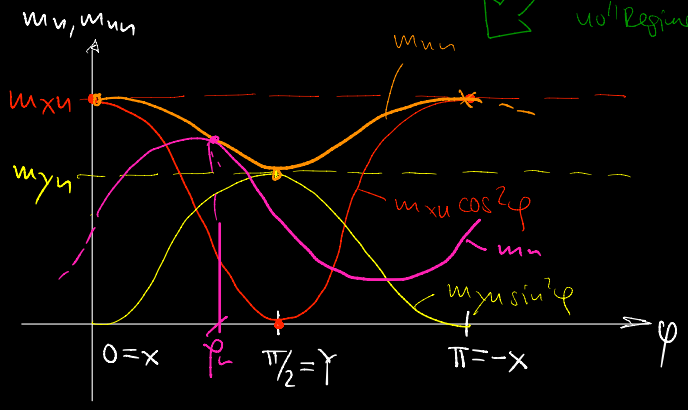
· orthogonal reinforcement:



Superimpose m_{xy}, m_{yx}

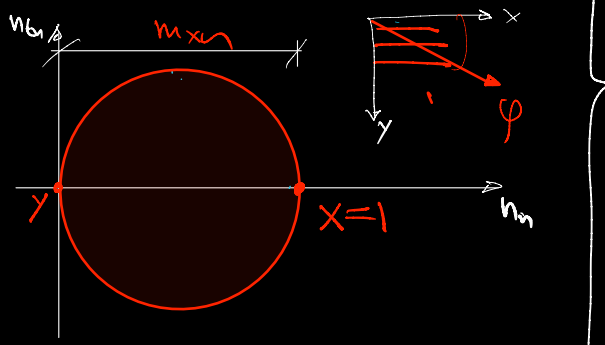


$m_{nn} \ge m_n \; \forall \varphi$ (≠ "add concrete", no "Regime I")

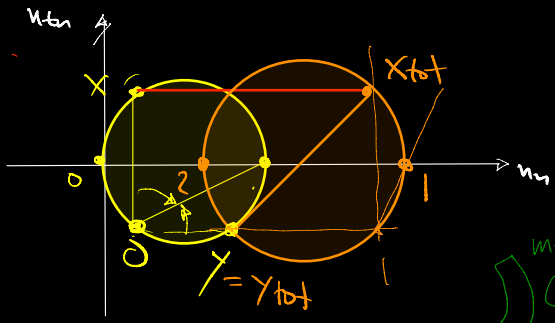


$$m_{nn} = m_{xn}\cos^2\varphi + m_{yn}\sin^2\varphi \ge$$
$$m_n = m_x\cos^2\varphi + m_y\sin^2\varphi + 2m_{xy}\cos^2\varphi$$

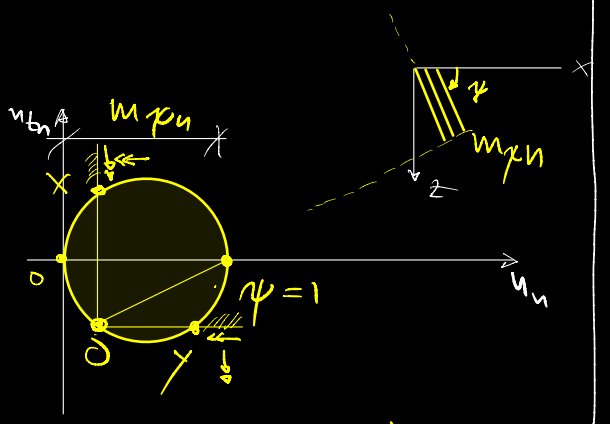
· Skew reinforcement

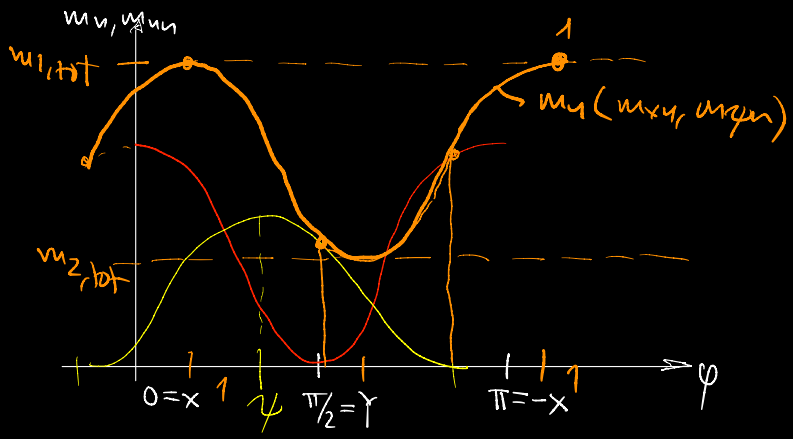


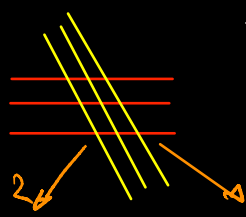
Superimpose m_{xy}, m_{yx}



$m_{nn} \ge m_n \; \forall \varphi$ (≠ "add concrete", no "Regime I")







$m_{2n} < \min\{m_{xn}, m_{yn}\}$ → $m_{1n} > \max\{m_{xy}, m_{yx}\}$