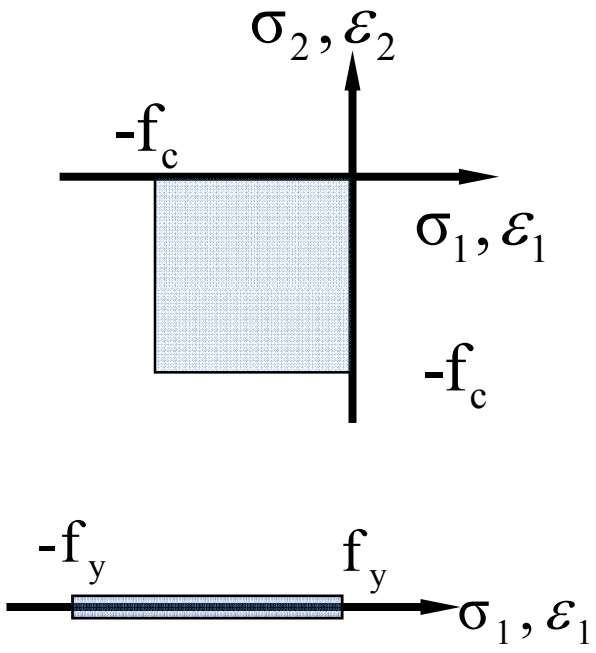
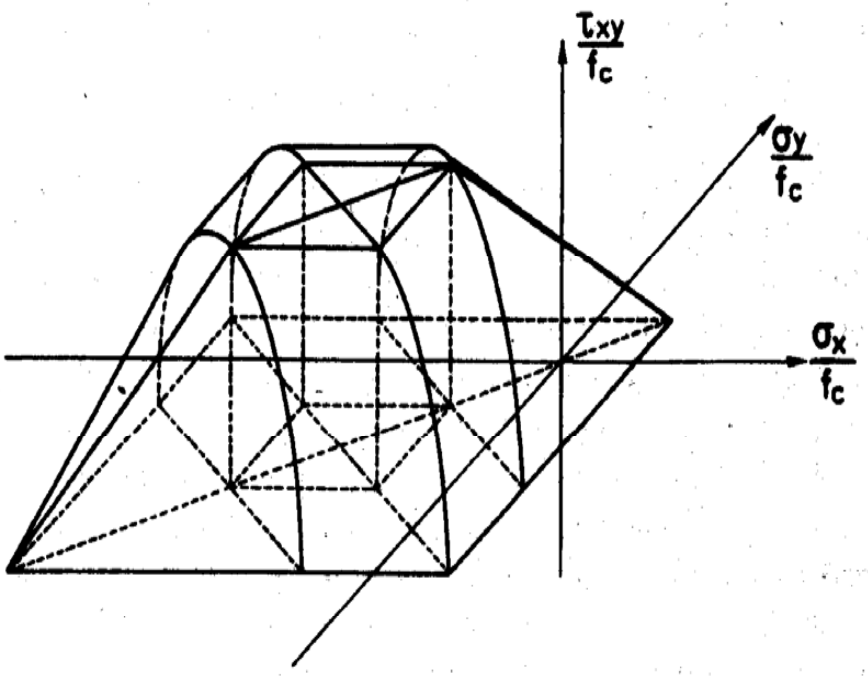
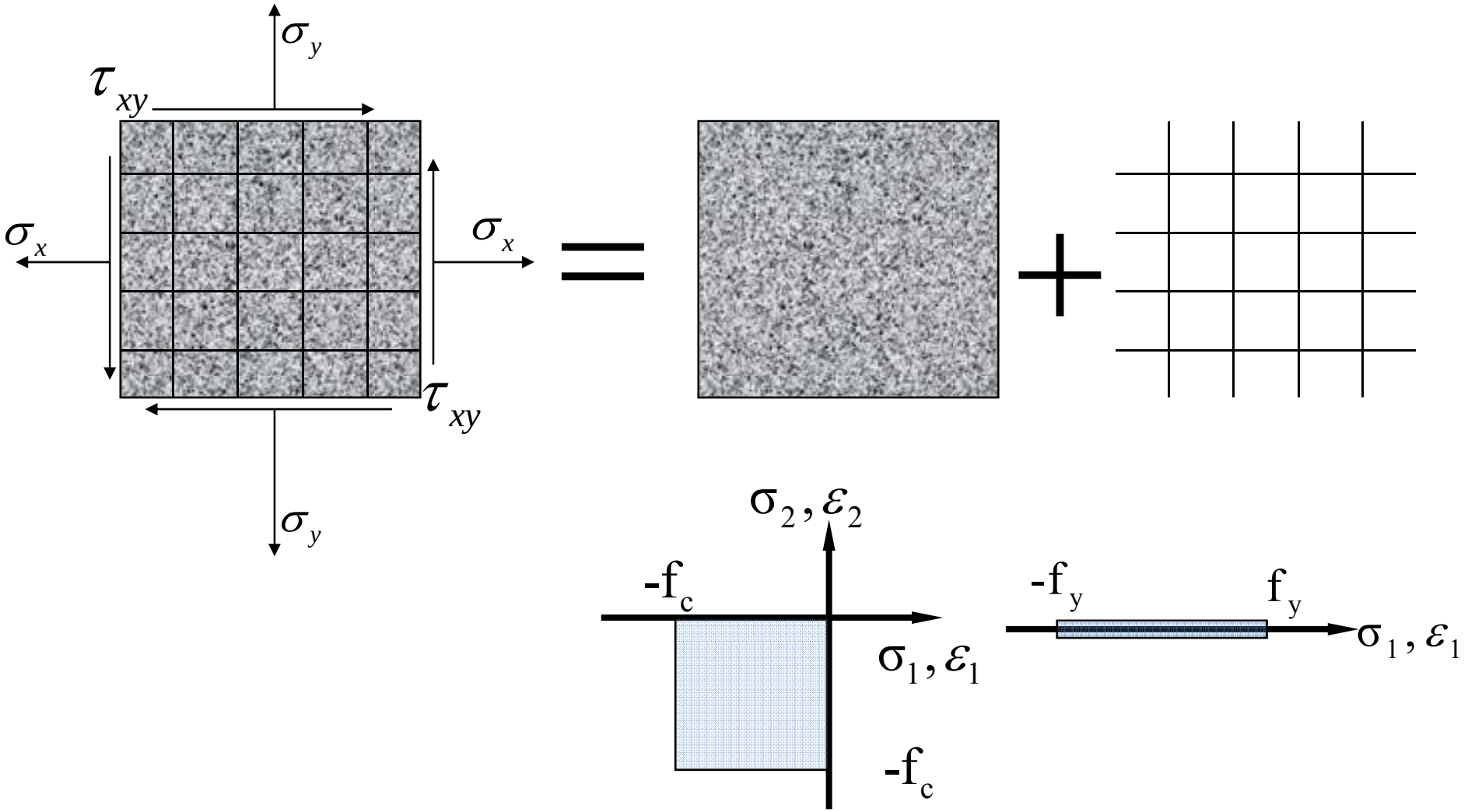
Yield condition for Disk

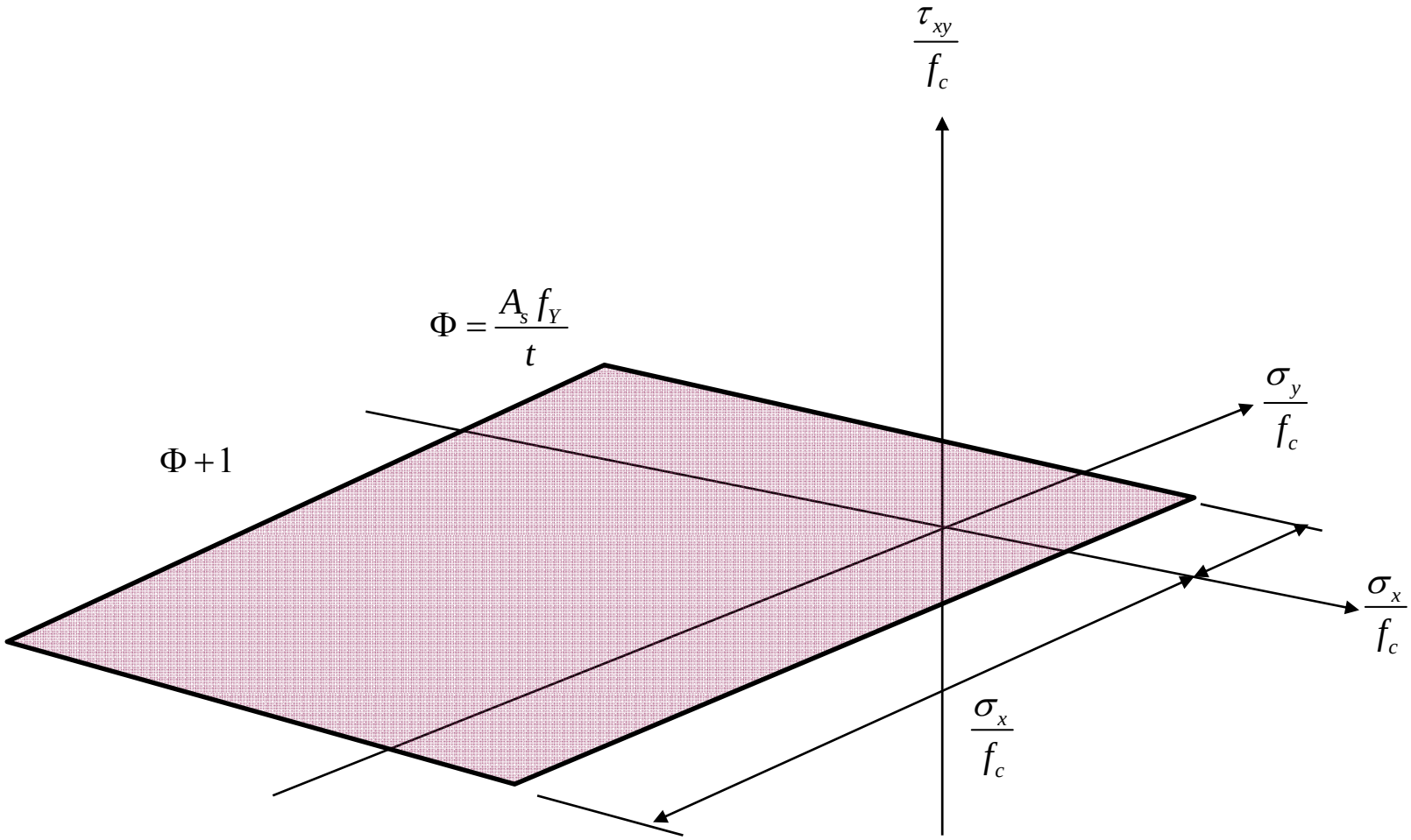




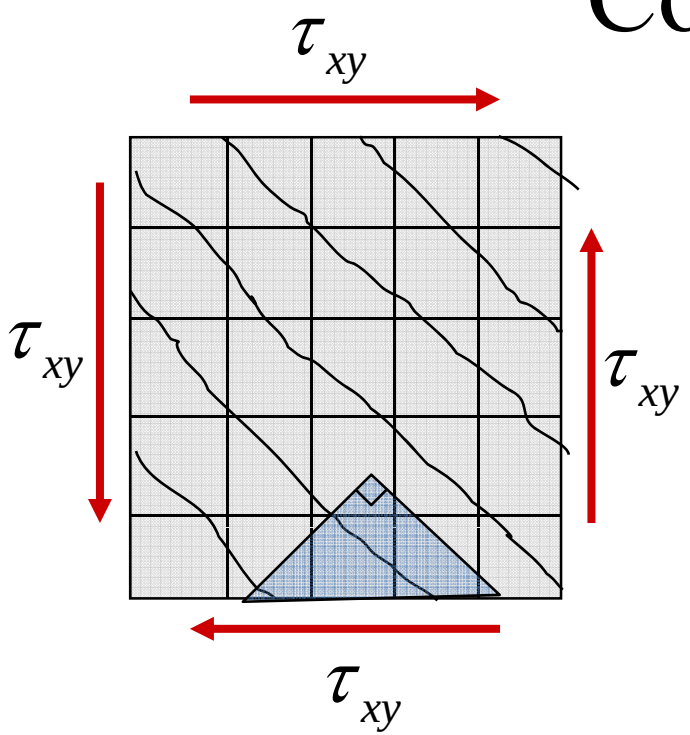
Disks in Plane Stresses

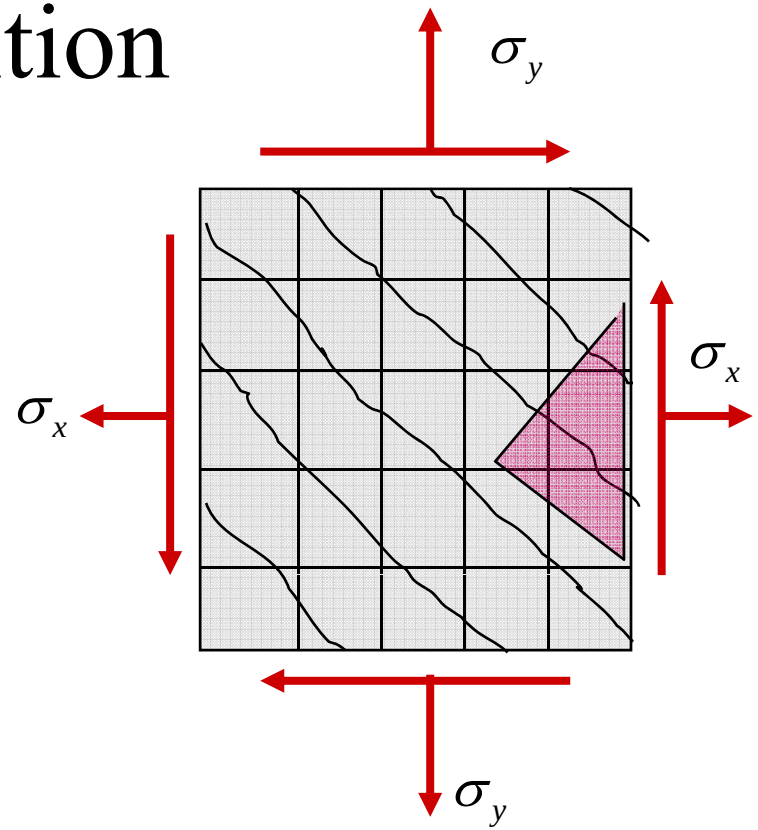


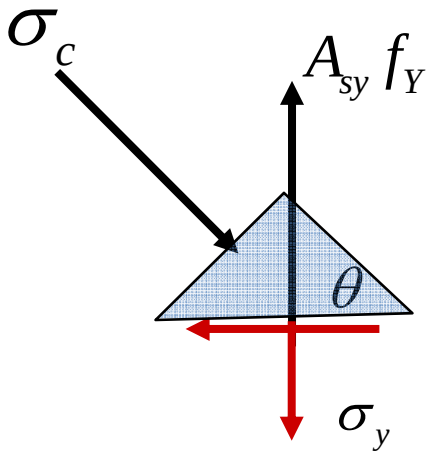
Yield Condition for Disk

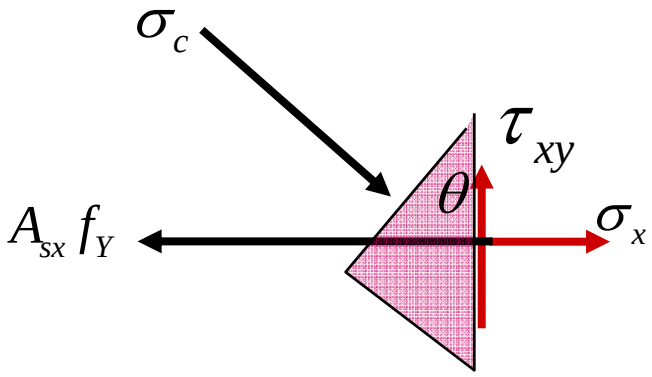


Free Body Diagram for Yield Condition

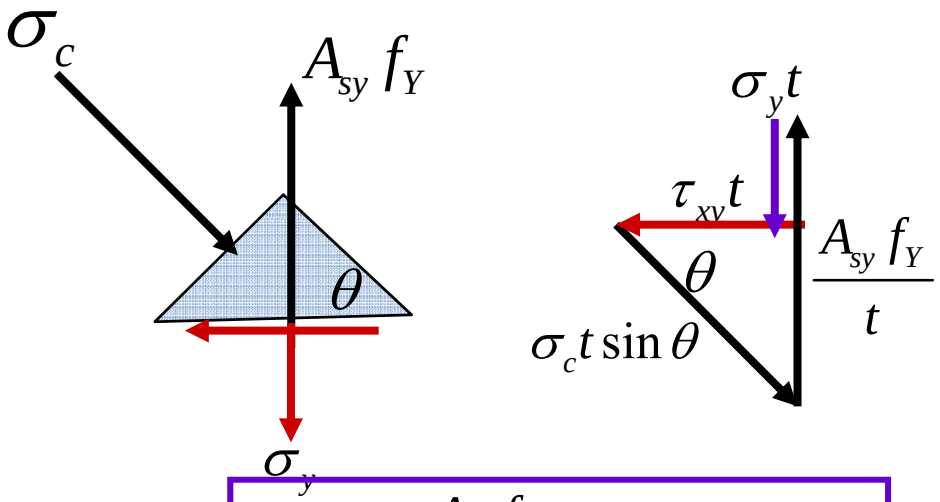






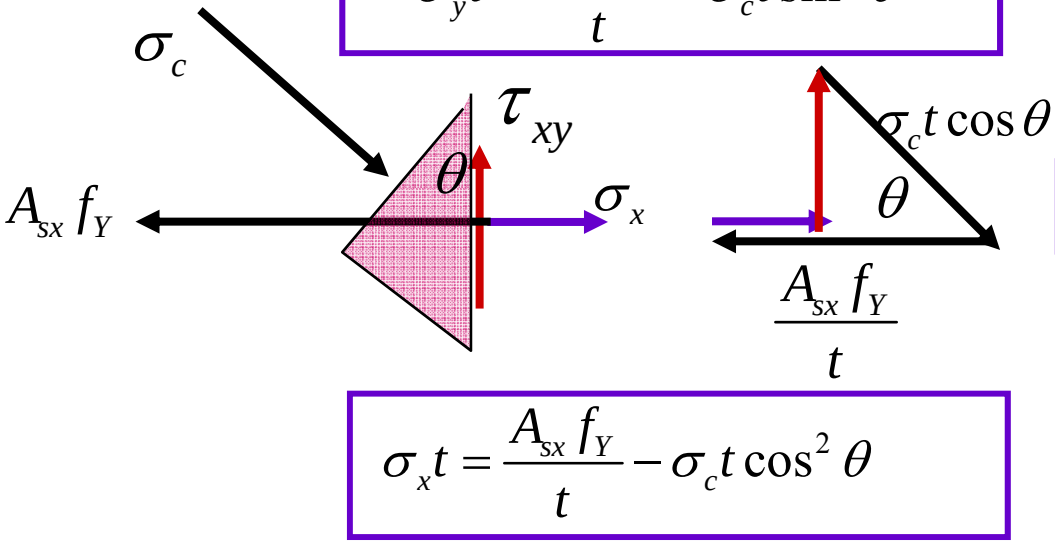


Shear strength



$$-\left(\Phi f_c - \sigma_x\right)\left(\Phi f_c - \sigma_y\right) + \tau_{xy}^2 = 0$$

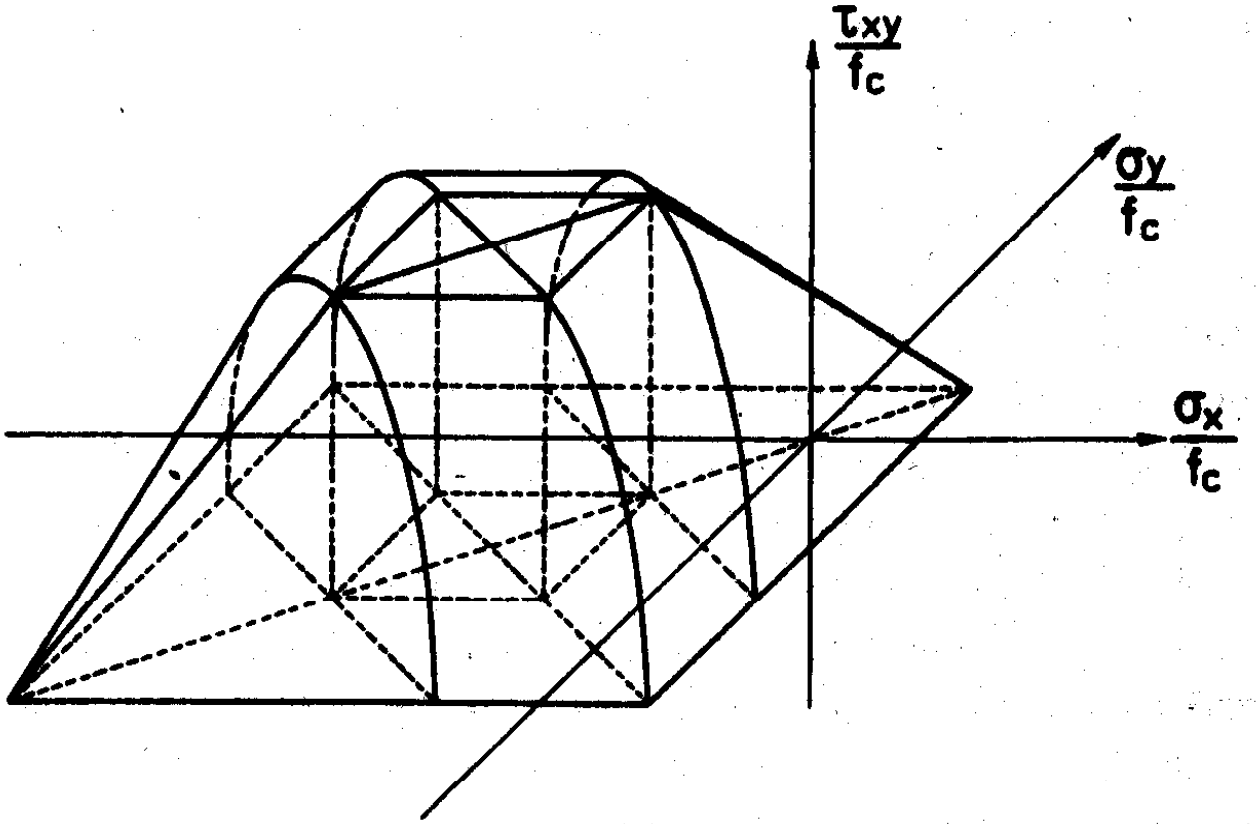
$$\sigma_y t = \frac{A_{sy}\, f_Y}{t} - \sigma_c t \sin^2\theta$$



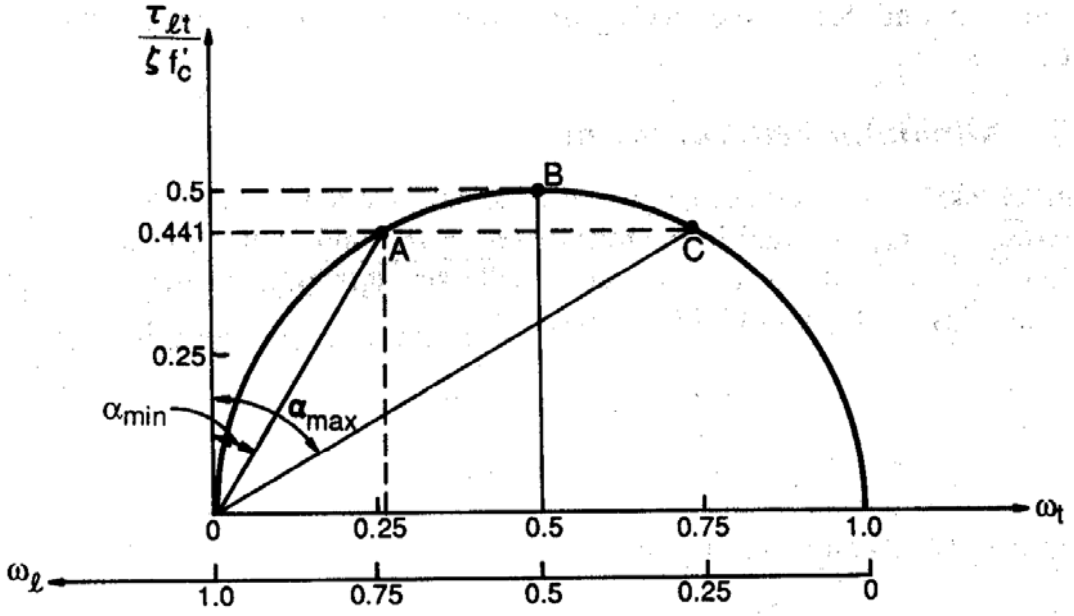
$$\tau_{xy} t = \sigma_c t \sin\theta \cos\theta$$

$$\sigma_x t = \frac{A_{sx}\, f_Y}{t} - \sigma_c t \cos^2\theta$$

Shear Strength of Disk



Relationship between Shear Strength and Reinforcement Ratio in Disk

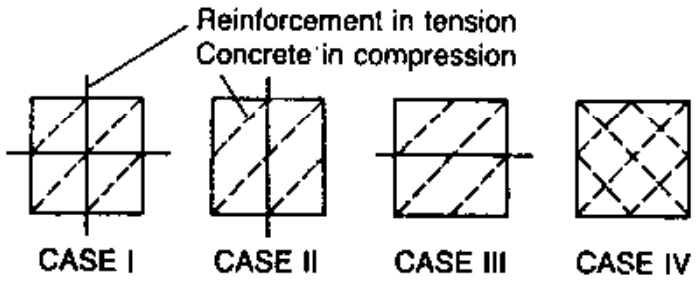


NOTE: CIRCULAR CURVE SATISFIES $\omega_\ell + \omega_t = 1$;
α_{min} AND α_{max} ACCORDING TO CEB CODE

Reinforcement in Disk based on Plasticity Solution

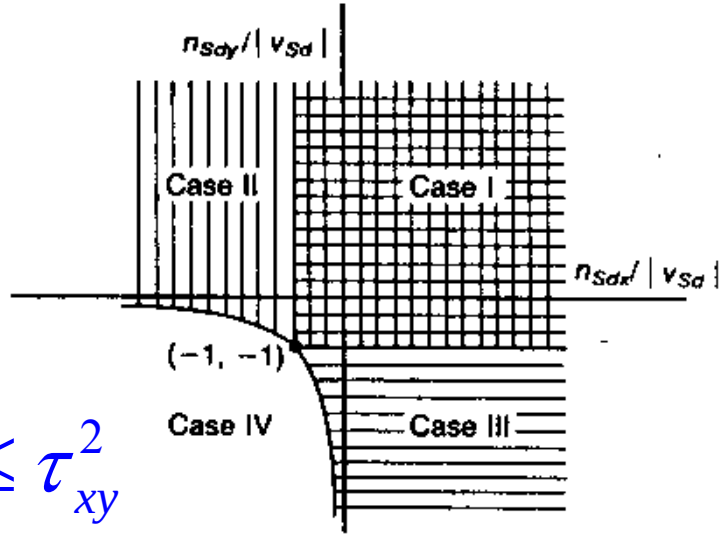
$$\frac{A_{sx} f_Y}{t} = \sigma_x + |\tau_{xy}|$$

$$\frac{A_{sy} f_Y}{t} = \sigma_y + |\tau_{xy}|$$



$$\sigma_x \le \sigma_y$$

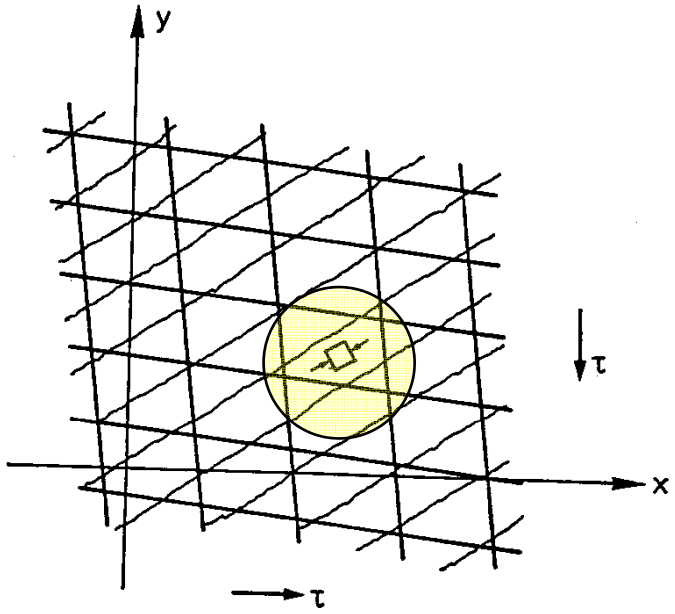
$$\sigma_x \ge -|\tau_{xy}|$$



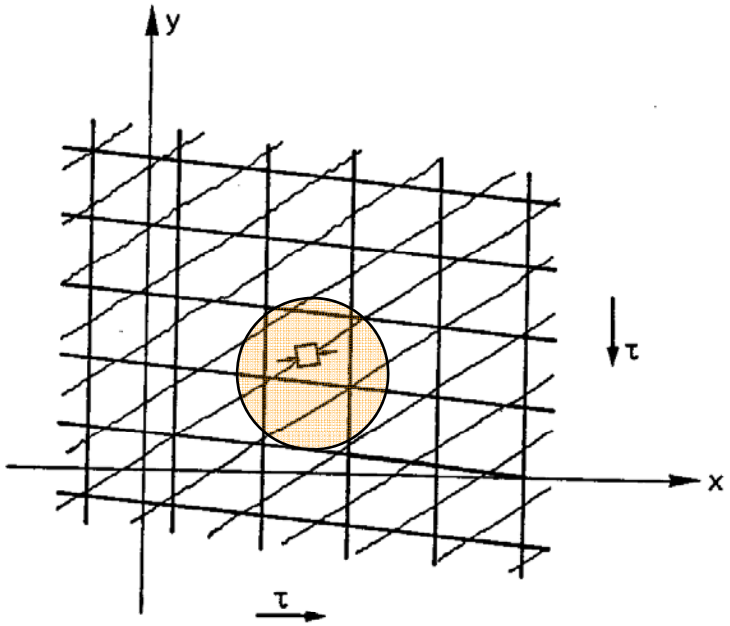
$$\sigma_x \sigma_y \le \tau_{xy}^2$$

Fig. 6.5.4. Systems of resistance

Failure Mechanisms in Disks



Failure mechanism for underreinforced element.



Failure mechanism for element overreinforced in the x-direction.

Yield conditions for Slabs

- Pure bending -> yield line theory and strip method
- Pure torsion -> Sandwich model