COSTRUZIONI NAVALI II

(materiali compositi: criteri di resistenza)

Criterio delle massime tensioni

$$\sigma_L^t < \sigma_{L_U}^t$$

$$\sigma_T^t < \sigma_{T_U}^t$$

$$|\tau_{LT}| < |\tau_{LT_U}|$$

$$|\sigma_L^c| < |\sigma_{L_U}^c|$$

$$|\sigma_T^c| < |\sigma_{T_U}^c|$$

Criterio delle massime deformazioni

$$\varepsilon_L^t < \varepsilon_{L_U}^t$$

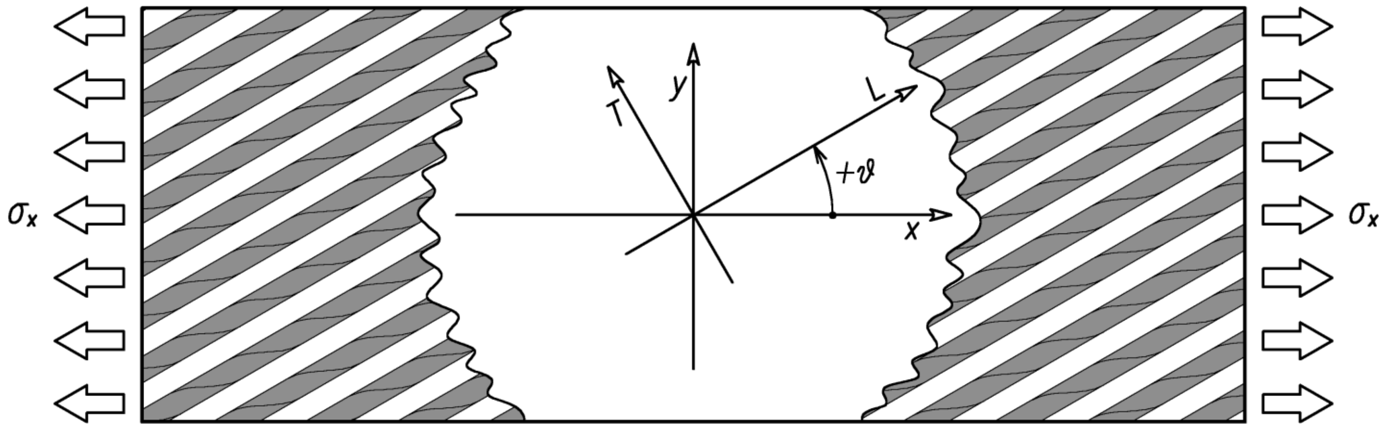
$$\varepsilon_T^t < \varepsilon_{T_U}^t$$

$$|\gamma_{LT}| < |\gamma_{LT_U}|$$

$$|\varepsilon_L^c| < |\varepsilon_{L_U}^c|$$

$$|\varepsilon_T^c| < |\varepsilon_{T_U}^c|$$

Lamina ortotropa soggetta a carico monoassiale



$$\begin{cases} \sigma_L = \sigma_x \cos^2\theta \\ \sigma_T = \sigma_x \sin^2\theta \\ \tau_{LT} = -\sigma_x \cos\theta \sin\theta \end{cases}$$

$$\begin{cases} \varepsilon_L = \dfrac{1}{E_L}\left(\cos^2\theta - \nu_{LT}\sin^2\theta\right)\sigma_x \\ \varepsilon_T = \dfrac{1}{E_T}\left(\sin^2\theta - \nu_{TL}\cos^2\theta\right)\sigma_x \\ \gamma_{LT} = -\dfrac{1}{G_{LT}}\left(\cos\theta \sin\theta\right)\sigma_x \end{cases}$$

Criterio di TSAI–HILL

$$F.I. = \left(\frac{\sigma_L}{\sigma_{L_U}}\right)^2 - \frac{\sigma_L \sigma_T}{\sigma_{L_U}^2} + \left(\frac{\sigma_T}{\sigma_{T_U}}\right)^2 + \left(\frac{\tau_{LT}}{\tau_{LT_U}}\right)^2$$

$\sigma_{L_U} = \sigma_{L_U}^t$	se	$\sigma_L > 0$	(trazione)	$\sigma_{T_U} = \sigma_{T_U}^t$	se	$\sigma_T > 0$
$\sigma_{L_U} = \sigma_{L_U}^c$	se	$\sigma_L < 0$	(compressione)	$\sigma_{T_U} = \sigma_{T_U}^c$	se	$\sigma_T < 0$

Criterio di TSAI–WU

$$F.I. = \left(F_1\,\sigma_L + F_2\,\sigma_T\right) + \left(F_{11}\,\sigma_L^2 + F_{22}\,\sigma_T^2 + 2\,F_{12}\,\sigma_L\,\sigma_T + F_{66}\,\tau_{LT}^2\right)$$

$$F_1 = \frac{1}{\sigma_{L_U}^t} - \frac{1}{|\sigma_{L_U}^c|}$$

$$F_2 = \frac{1}{\sigma_{T_U}^t} - \frac{1}{|\sigma_{T_U}^c|}$$

$$F_{11} = \frac{1}{\sigma_{L_U}^t\,|\sigma_{L_U}^c|}$$

$$F_{22} = \frac{1}{\sigma_{T_U}^t\,|\sigma_{T_U}^c|}$$

$$F_{66} = \frac{1}{\tau_{LT_U}^2}$$

$$F_{12} = -\frac{1}{2}\sqrt{\frac{1}{\sigma_{L_U}^t\;\sigma_{L_U}^c\;\sigma_{T_U}^t\;\sigma_{T_U}^c}}$$

Verifica di resistenza di un laminato

$$\left\{\begin{array}{c}\underline{N}\\\underline{M}\end{array}\right\}=\left[\begin{array}{cc}\underline{\underline{A}} & \underline{\underline{B}}\\\underline{\underline{B}} & \underline{\underline{D}}\end{array}\right]\left\{\begin{array}{c}\underline{\varepsilon}^{o}\\\underline{\chi}\end{array}\right\}$$

$$\left\{\begin{array}{c}\underline{\varepsilon}^{o}\\\underline{\chi}\end{array}\right\}=\left[\begin{array}{cc}\underline{\underline{A}} & \underline{\underline{B}}\\\underline{\underline{B}} & \underline{\underline{D}}\end{array}\right]^{-1}\left\{\begin{array}{c}\underline{N}\\\underline{M}\end{array}\right\}$$

$$\left\{\begin{array}{c}\underline{\varepsilon}^{o}\\\underline{\chi}\end{array}\right\}=\left[\begin{array}{cc}\underline{\underline{A}}^{-1} & \underline{\underline{0}}\\\underline{\underline{0}} & \underline{\underline{D}}^{-1}\end{array}\right]\left\{\begin{array}{c}\underline{N}\\\underline{M}\end{array}\right\}$$

$$\underline{\varepsilon}_{(x,y)_k}=\underline{\varepsilon}^{o}_{(x,y)}+z\,\underline{\chi}_{(x,y)}$$

$$\underline{\varepsilon}^{*}_{(L,T)_k}=\underline{\underline{T}}(\theta_k)\,\underline{\varepsilon}^{*}_{(x,y)_k}$$

$$\underline{\varepsilon}_{(L,T)_k}$$

$$\underline{\sigma}_{(L,T)_k}=\underline{\underline{Q}}_k\,\underline{\varepsilon}_{(L,T)_k}$$

$$F.I._k<1$$