UFPR	Formulário	TMEC-020	Mecânica dos Sólidos II

$$(\nabla\vec{\mathbf{v}})_{ij} = v_{i,j} \qquad \frac{\partial}{\partial r}\,\vec{\mathbf{v}} = (\nabla\vec{\mathbf{v}})\vec{\mathbf{e}} \qquad \mathbf{T}\,\vec{\mathbf{e}}_\mathbf{i} = T_{ji}\vec{\mathbf{e}}_\mathbf{j} \qquad \mathbf{T}\,\vec{\mathbf{v}} = T_{ij}v_j\vec{\mathbf{e}}_\mathbf{i}$$

$$T_{ij} = \vec{\mathbf{e}}_\mathbf{i}\cdot\mathbf{T}\vec{\mathbf{e}}_\mathbf{j} \qquad Q_{ij} = \vec{\mathbf{e}}_\mathbf{i}\cdot\vec{\mathbf{e}}'_\mathbf{j} \qquad \{\mathrm{v}\}' = [\mathrm{Q}]^T\{\mathrm{v}\} \qquad [\mathrm{T}]' = [\mathrm{Q}]^T[\mathrm{T}][\mathrm{Q}]$$

$$|[\mathrm{T}] - \lambda\,[\mathrm{I}]| = 0 \qquad (\mathbf{T} - \lambda\,\mathbf{I})\,\vec{\mathbf{n}} = \vec{\mathbf{0}} \qquad (\mathbf{T}+\mathbf{S})_{ij} = T_{ij} + S_{ij} \qquad (\mathbf{TS})_{ij} = T_{im}S_{mj}$$

$$\mathbf{T} = \lambda\,(\operatorname{tr}\mathbf{E}\,)\,\mathbf{I} + 2\,\mu\,\mathbf{E} \qquad \mathbf{E} = \frac{1}{2\,\mu}\left(\mathbf{T} - \frac{\lambda}{3\,\lambda + 2\,\mu}\,(\operatorname{tr}\mathbf{T}\,)\,\mathbf{I}\right) \qquad \widehat{U} = \frac{1+\nu}{2\,E_y}\operatorname{tr}\mathbf{T^2} - \frac{\nu}{2\,E_y}(\operatorname{tr}\mathbf{T}\,)^2$$

$$\mathbf{T} = \frac{E_y\nu}{(1+\nu)(1-2\nu)}\,(\operatorname{tr}\mathbf{E}\,)\,\mathbf{I} + \frac{E_y}{1+\nu}\,\mathbf{E} \qquad \mathbf{E} = \frac{1+\nu}{E_y}\mathbf{T} - \frac{\nu}{E_y}\,(\operatorname{tr}\mathbf{T}\,)\,\mathbf{I} \qquad G = \frac{E_y}{2\,(1+\nu)}$$

$$\widehat{U} = \frac{1+\nu}{2\,E_y}\operatorname{tr}\mathbf{T^2} - \frac{\nu}{2\,E_y}(\operatorname{tr}\mathbf{T}\,)^2 = \frac{1+\nu}{2\,E_y}\left(T_{11}^2 + T_{22}^2 + T_{33}^2 + 2\,T_{12}^2 + 2\,T_{13}^2 + 2\,T_{23}^2\right) - \frac{\nu}{2\,E_y}\left(T_{11}+T_{22}+T_{33}\right)^2$$

$$\widehat{U}_d = \frac{1+\nu}{2\,E_y}\operatorname{tr}\mathbf{T^2} - \frac{1+\nu}{6\,E_y}(\operatorname{tr}\mathbf{T}\,)^2 = \frac{1+\nu}{6\,E_y}\left[(T_{11}-T_{22})^2 + (T_{11}-T_{33})^2 + (T_{22}-T_{33})^2 + 6\,(T_{12}^2 + T_{13}^2 + T_{23}^2)\right]$$

$$\sigma_{vm}^2 = \frac{(T_{11}-T_{22})^2 + (T_{11}-T_{33})^2 + (T_{22}-T_{33})^2 + 6\,(T_{12}^2+T_{13}^2+T_{23}^2)}{2} = \frac{(\sigma_1-\sigma_2)^2 + (\sigma_1-\sigma_3)^2 + (\sigma_2-\sigma_3)^2}{2}$$

$$\sigma_e^2 > (\text{ou } \leq)\,\frac{(\sigma_1-\sigma_2)^2 + (\sigma_1-\sigma_3)^2 + (\sigma_2-\sigma_3)^2}{2} = \sigma_{vm}^2$$

$$\mathit{\Pi} = \int_0^L \frac{E_y I}{2}(u_{2,11})^2\,dx_1 - \int_0^L q\,u_2\,dx_1 \qquad \mathit{\Pi} = \int_0^L \frac{E_y I}{2}(u_{2,11})^2\,dx_1 - F\,u_2(x_{1_F})$$

$$C_c = \sqrt{\frac{2\pi^2 E_y}{\sigma_e}} \qquad \sigma_{\text{adm}} = \frac{\pi^2 E_y}{1{,}92\left(\frac{KL}{r}\right)^2} \qquad s = \frac{5}{3} + \frac{3}{8}\frac{\frac{KL}{r}}{C_c} - \frac{1}{8}\left(\frac{\frac{KL}{r}}{C_c}\right)^3$$

$$r = \sqrt{\frac{I}{A}} \qquad \sigma_{\text{adm}} = \frac{\sigma_e}{s}\left[1 - 0{,}5\left(\frac{\frac{KL}{r}}{C_c}\right)^2\right]$$

$$I = \frac{b\,h^3}{12} \qquad I = \frac{\pi\,c^4}{4} \qquad \delta = \int_0^L \frac{N\,N^*}{E_y\,A}\,dx + \int_0^L \frac{M\,M^*}{E_y\,I}\,dx$$