

带参数材料编程

stable orthotropic material (定义材料)

$C_{6 \times 6}$ ($E_1, E_2, E_3, \nu_{12}, \nu_{23}, \nu_{31}, \mu_{12}, \mu_{13}, \mu_{31}$)
共轭线弹性材料模型

$$\sigma = C \cdot \varepsilon \leftarrow C = \begin{bmatrix} \frac{1}{E_1} & -\frac{\nu_{21}}{E_2} & -\frac{\nu_{31}}{E_3} & 0 & 0 & 0 \\ & \frac{1}{E_2} & -\frac{\nu_{32}}{E_3} & 0 & 0 & 0 \\ & & \frac{1}{E_3} & 0 & 0 & 0 \\ & & & \frac{1}{\mu_{12}} & 0 & 0 \\ & & & & \frac{1}{\mu_{23}} & 0 \\ & & & & & \frac{1}{\mu_{31}} \end{bmatrix}$$

Sym

$\Psi(\Sigma) = ?$

ISO: $\Psi(F) = \nu \|\Sigma - I\|_F^2 + \frac{\lambda}{2} \text{tr}^2(\Sigma - I)$

$\Psi_{\text{iso}} + \Psi_{\text{ortho}}$

$$\begin{aligned} & f(\lambda_1) + f(\lambda_2) + f(\lambda_3) \\ & + g(\lambda_1, \lambda_2) + g(\lambda_2, \lambda_3) + g(\lambda_3, \lambda_1) \\ & + h(\lambda_1, \lambda_2, \lambda_3) \\ & + w(\bar{\lambda}_1) + w(\bar{\lambda}_2) + w(\bar{\lambda}_3) \end{aligned}$$

$$\begin{aligned} f(x) &= \frac{1}{2} \lambda (x^2 - 6x + 5) + \mu (2 - 2x) \\ g(x) &= \lambda (x - 1) + \mu (x - 1) \\ h(x) &= 0 \end{aligned}$$

判断参数对应关系

$\Psi_{\text{iso}}: (E_1, E_2, E_3, \nu_{12}, \dots, \mu_{12}, \dots) \Rightarrow (E, \nu)$

$\Psi_{\text{ortho}}: (E_1, \dots, \nu_{12}, \dots, \mu_{12}, \dots) \Rightarrow (\dots)$

???

同样的关系用到其他材料模型

(VK, Neo-Hooke)