

→ Kraft-Verformungs-Beziehung für den Stab (in 3-dim.)

$$\vec{F} = [T^T] \cdot [\vec{k}] \cdot [T] \vec{u}$$

$$\begin{bmatrix} F_1 \\ F_2 \\ F_3 \\ F_4 \\ F_5 \\ F_6 \end{bmatrix} = \begin{bmatrix} \frac{\partial^2 u}{\partial x^2} & \frac{\partial^2 u}{\partial x \partial y} & \frac{\partial^2 u}{\partial x \partial z} \\ \frac{\partial^2 u}{\partial x \partial y} & \frac{\partial^2 u}{\partial y^2} & \frac{\partial^2 u}{\partial y \partial z} \\ \frac{\partial^2 u}{\partial x \partial z} & \frac{\partial^2 u}{\partial y \partial z} & \frac{\partial^2 u}{\partial z^2} \end{bmatrix} \begin{bmatrix} \frac{E A}{l} & -\frac{E A}{l} & 0 \\ -\frac{E A}{l} & \frac{E A}{l} & 0 \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} \frac{\partial^2 u}{\partial x^2} & \frac{\partial^2 u}{\partial x \partial y} & \frac{\partial^2 u}{\partial x \partial z} \\ \frac{\partial^2 u}{\partial x \partial y} & \frac{\partial^2 u}{\partial y^2} & \frac{\partial^2 u}{\partial y \partial z} \\ \frac{\partial^2 u}{\partial x \partial z} & \frac{\partial^2 u}{\partial y \partial z} & \frac{\partial^2 u}{\partial z^2} \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \\ u_3 \\ u_4 \\ u_5 \\ u_6 \end{bmatrix}$$

$[k]$ - Steifigkeitsmatrix des Stabes in 3-dim.

gilt für

$$u_6 \ll l$$

$$C_6 = (\dots 6)$$

mit

$$l = \sqrt{\Delta x^2 + \Delta y^2 + \Delta z^2}$$