**Hooke matrix for plane stress state**

$$\mathbf{D} = \frac{E}{1-\nu^2}\begin{bmatrix} 1 & \nu & 0 \\ \nu & 1 & 0 \\ 0 & 0 & \frac{1-\nu}{2} \end{bmatrix}$$

**Matrix $\mathbf{K}^e$ for stationary heat flow in 2D**

$$\mathbf{K}^e = \int_{A^e} \mathbf{B}^{\mathrm{T}}\,\mathbf{D}\,\mathbf{B}\,\mathrm{d}A^e$$

$$\mathbf{B}(x,y) = \begin{bmatrix} N_{1,x} & N_{2,x} & N_{3,x} & ... \\ N_{1,y} & N_{2,y} & N_{3,y} & ... \end{bmatrix}\ ,\ \mathbf{D} = \begin{bmatrix} k_x & 0 \\ 0 & k_y \end{bmatrix}$$

**Matrix $\mathbf{K}^e$ for plane stress state**

$$\mathbf{K}^e = \int_{A^e} \mathbf{B}^{\mathrm{T}}\,\mathbf{D}\,\mathbf{B}\,\mathrm{d}A^e$$

$$\mathbf{B}(x,y) = \begin{bmatrix} N_{1,x} & 0 & N_{2,x} & 0 & N_{3,x} & 0 & ... \\ 0 & N_{1,y} & 0 & N_{2,y} & 0 & N_{3,y} & ... \\ N_{1,y} & N_{1,x} & N_{2,y} & N_{2,x} & N_{3,y} & N_{3,x} & ... \end{bmatrix}$$

**Strains in plane stress state**

$$\boldsymbol{\varepsilon} = \begin{bmatrix} \varepsilon_{xx} \\ \varepsilon_{yy} \\ \gamma_{xy} \end{bmatrix} = \begin{bmatrix} u_{x,x} \\ u_{y,y} \\ u_{x,y} + u_{y,x} \end{bmatrix}$$

**Interpolation functions for rectangular finite element**

$$N_1(x,y) = \frac{(x-x_2)(y-y_4)}{(x_1-x_2)(y_1-y_4)}$$

$$N_2(x,y) = \frac{(x-x_1)(y-y_3)}{(x_2-x_1)(y_2-y_3)}$$

$$N_3(x,y) = \frac{(x-x_4)(y-y_2)}{(x_3-x_4)(y_3-y_2)}$$

$$N_4(x,y) = \frac{(x-x_3)(y-y_1)}{(x_4-x_3)(y_4-y_1)}$$