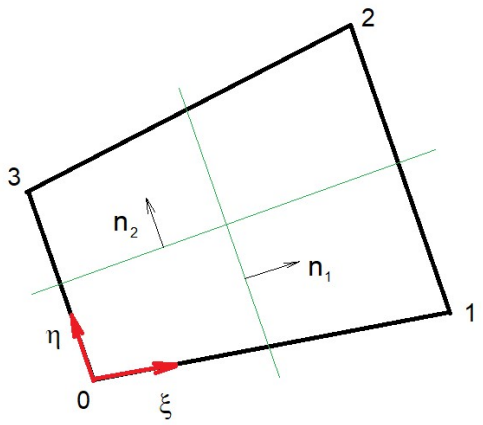

Temperature distribution in an element

$$T(\xi,\eta)=\begin{Bmatrix}(1-\xi)(1-\eta)\\ \xi(1-\eta)\\ \xi\cdot\eta\\ \eta(1-\xi)\end{Bmatrix}^{T}\begin{Bmatrix}T_0\\T_1\\T_2\\T_3\end{Bmatrix}$$

$$\begin{Bmatrix}\frac{\partial x}{\partial\xi}(\eta)\\ \frac{\partial x}{\partial\eta}(\xi)\end{Bmatrix}=\begin{bmatrix}-(1-\eta) & (1-\eta) & \eta & -\eta\\ -(1-\xi) & -\xi & \xi & (1-\xi)\end{bmatrix}\begin{Bmatrix}x_0\\x_1\\x_2\\x_3\end{Bmatrix}$$

$$\begin{Bmatrix}\frac{\partial y}{\partial\xi}(\eta)\\ \frac{\partial y}{\partial\eta}(\xi)\end{Bmatrix}=\begin{bmatrix}-(1-\eta) & (1-\eta) & \eta & -\eta\\ -(1-\xi) & -\xi & \xi & (1-\xi)\end{bmatrix}\begin{Bmatrix}y_0\\y_1\\y_2\\y_3\end{Bmatrix}$$

Normal {n1} and {n2} to middle lines:

$$Q_{n_1}(\eta)=\frac{\lambda}{\sqrt{\left(\frac{\partial x}{\partial\xi}\right)^2+\left(\frac{\partial y}{\partial\xi}\right)^2}}\frac{\partial T}{\partial\xi}=\frac{\lambda}{\sqrt{\left(\frac{\partial x}{\partial\xi}\right)^2+\left(\frac{\partial y}{\partial\xi}\right)^2}}\begin{Bmatrix}-(1-\eta)\\(1-\eta)\\\eta\\-\eta\end{Bmatrix}^{T}\begin{Bmatrix}T_0\\T_1\\T_2\\T_3\end{Bmatrix}$$

$$Q_{n_2}(\xi)=\frac{\lambda}{\sqrt{\left(\frac{\partial x}{\partial\eta}\right)^2+\left(\frac{\partial y}{\partial\eta}\right)^2}}\frac{\partial T}{\partial\eta}=\frac{\lambda}{\sqrt{\left(\frac{\partial x}{\partial\eta}\right)^2+\left(\frac{\partial y}{\partial\eta}\right)^2}}\begin{Bmatrix}-(1-\xi)\\-\xi\\\xi\\(1-\xi)\end{Bmatrix}^{T}\begin{Bmatrix}T_0\\T_1\\T_2\\T_3\end{Bmatrix}$$

Length of middle lines:

$$l_1=\frac{1}{2}\sqrt{(x_0+x_1-x_2-x_3)^2+(y_2+y_3-y_0-y_1)^2}$$

$$l_2=\frac{1}{2}\sqrt{(x_0+x_3-x_1-x_2)^2+(y_0+y_3-y_1-y_2)^2}$$

$$S_0 = \frac{1}{16}\left(2x_1y_3 - 2x_3y_1 + (3x_0 - x_2)(y_1 - y_3) + (3y_0 - y_2)(x_3 - x_1)\right)$$

$$S_1 = \frac{1}{16}\left(2x_2y_0 - 2x_0y_2 + (3x_1 - x_3)(y_2 - y_0) + (3y_1 - y_3)(x_0 - x_2)\right)$$

$$S_2 = \frac{1}{16}\left(2x_3y_1 - 2x_1y_3 + (3x_2 - x_0)(y_3 - y_1) + (3y_2 - y_0)(x_1 - x_3)\right)$$

$$S_3 = \frac{1}{16}\left(2x_0y_2 - 2x_2y_0 + (3x_3 - x_1)(y_0 - y_2) + (3y_3 - y_1)(x_2 - x_0)\right)$$