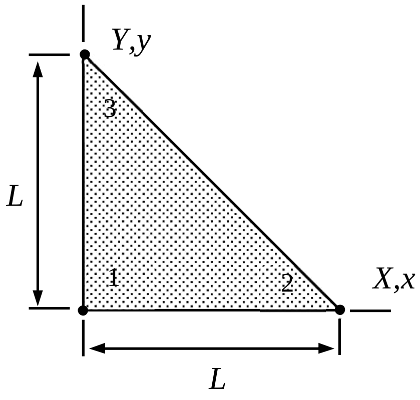
Name______________________________ Student number____________________

Assignment 2

Consider the temperature distribution in the structure shown which is composed of one triangle element. Assuming that the thermal conductivity k and thickness t of the element are constants, derive the element contribution δP^{int}. Temperature at nodes 1 and 2 is known to be ϑ° and the unknown nodal temperature is ϑ_3.



Solution template

In stationary thermo-elasticity, the variational densities of the thin slab mode of the plate model

$$\delta p_{\Omega}^{\mathrm{int}} = -\begin{Bmatrix} \partial\delta\vartheta/\partial x \\ \partial\delta\vartheta/\partial y \end{Bmatrix}^{\mathrm{T}} kt \begin{Bmatrix} \partial\vartheta/\partial x \\ \partial\vartheta/\partial y \end{Bmatrix}, \quad \delta p_{\Omega}^{\mathrm{ext}} = \delta\vartheta s$$

represent the energy balance. Linear shape functions of the temperature approximation can be deduced from the figure

$$N_2 = \underline{\qquad\qquad}, \quad N_3 = \underline{\qquad\qquad}, \quad N_1 = 1 - N_2 - N_3 = \underline{\qquad\qquad\quad}.$$

Approximation to $\vartheta(x,y)$ and its variation $\delta\vartheta(x,y)$ (notice that the variation of a given quantity vanishes)

$$\vartheta = \underline{\qquad\qquad\qquad}, \quad \frac{\partial\vartheta}{\partial x} = \underline{\qquad\qquad\qquad}, \quad \frac{\partial\vartheta}{\partial y} = \underline{\qquad\qquad\qquad},$$

$$\delta\vartheta = \underline{\qquad\qquad\qquad}, \quad \frac{\partial\delta\vartheta}{\partial x} = \underline{\qquad\qquad\qquad}, \quad \frac{\partial\delta\vartheta}{\partial y} = \underline{\qquad\qquad\qquad}.$$

When the approximation is substituted there, the variational density simplifies to

$$\delta p_{\Omega}^{\mathrm{int}} = \underline{\qquad\qquad\qquad\qquad\qquad\qquad\qquad}.$$

Integration over the element gives

$$\delta P^{\mathrm{int}} = \int_{\Omega} \delta p_{\Omega}^{\mathrm{int}} dA = \underline{\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad}.$$