

FINITE ELEMENT EQUATIONS

- Differential equation (e.g conductive heat transfer)

$$0 = Q + k \nabla^2 T$$

- Interpolation among nodal temperatures:

$$\tilde{T}(x, y) = N_j(x, y) T_j$$

- Galerkin weighted residual:

$$\int_V N_i (Q + k \nabla^2 \tilde{T}) dV = R \approx 0$$

- Substituting, integrating by parts:

$$k_{ij} T_j = q_i$$

where

$$k_{ij} = \int_V \nabla N_i k \nabla N_j dV + \int_{\Gamma} N_i h N_j d\Gamma$$

and

$$q_i = \int_V N_i Q dV + \int_{\Gamma} N_i h T_a d\Gamma$$