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:

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

- 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

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

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Fall 1999