LATIN SYMBOLS

$x, y, z$  Cartesian, Global axes

$x_i, y_i, z_i$  Global coordinates at node $i$ of the element

$\{u^e\}$  Element nodal displacement vector

$\{\delta u^e\}$  Element nodal virtual displacement vector

$u_i, v_i, w_i$  Element nodal displacement degrees of freedom at node $i$

$[N]$  Interpolation or shape function matrix

$[B]$  Strain-displacement matrix

$[D]$  Constitutive matrix

$E$  Young's modulus

$T$  Temperature

$V$  Volume

$V_e$  Element volume

$S$  Surface

$S_e$  Element surface area

$\{r^e\}$  Element load vector

$[k^e]$  Element stiffness matrix

$\{b\}$  Element body force vector

$\{p\}$  Element surface force vector

$[K]$  Global stiffness matrix

$\{U\}$  Global displacement vector
\( n_{eq} \) Number of equations
\( n \) Number of nodes per element
\([J]\) Jacobian matrix
\( \{R\} \) Global load vector
\( \{R_f\} \) Applied loads
\( \{R_r\} \) Support reaction
\( \{U_f\} \) Free degrees of freedom
\( Z \) Section modulus

\( N_{\xi_i}, N_{\eta_j}, N_{\zeta_k} \) Shape functions of point \((i, j, k)\) in \(\xi, \eta, \zeta\) directions

\( L, T, H \) Length, thickness and Height directions of a cube
\( nL, nT, nH \) Divisions in Length, Thickness and Height
\( dA \) Element face area
\( i, j, k \) Unit vectors along \(x, y, z\) directions
\( e_1, e_2, e_3 \) Vectors along \(\xi, \eta, \zeta\) directions
\( e'_1, e'_2, e'_3 \) Vectors along \(\xi', \eta', \zeta'\) directions
\( l, m, n \) Direction cosines
\( \rho_L \) Fluid density
\( q \) Intensity of pressure normal to any surface
\( z_{ref} \) Fluid surface datum
\( N_i^s \) Surface shape function for the node \(i\).
\( P_e \) Hydrodynamic pressure
\( C_s \) Coefficient varies with shape and depth
\( w \) Unit weight of water
\( h \) Depth of reservoir in m
\( C_m \) Maximum value of Cs

\( P_w \) Maximum pressure intensity due to wave action

\( h_w \) Height of wave

**GREEK SYMBOLS**

\( \xi, \eta, \zeta \) Local, Natural axes

\( \xi_i, \eta_i, \zeta_i \) Local coordinates at node i of the element

\( \{\sigma\} \) Element stress vector

\( \{\varepsilon\} \) Element strain vector

\( \{\delta\varepsilon\} \) Virtual strain

\( \mu \) Poisson’s ratio

\( \alpha \) Coefficient of thermal expansion

\( \alpha_x, \alpha_y, \alpha_z \) Earthquake intensities in x, y, z directions

\( \alpha_h \) Design horizontal seismic coefficient