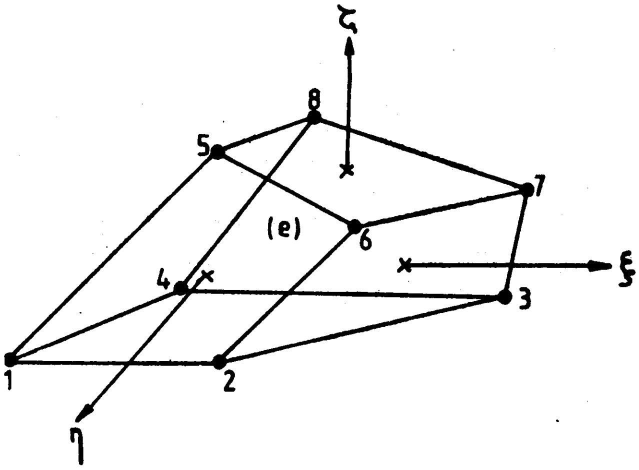

Fig. 8.7(a) Hexahedron element

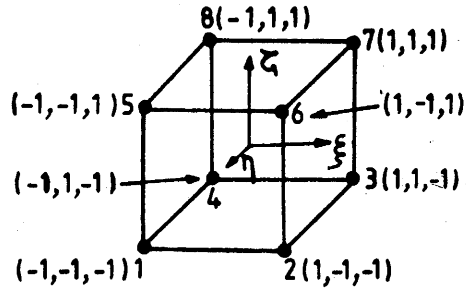

Fig. 8.7(b) Mapping into cube

Linear Lagrange polynomial

The linear piecewise polynomial is given by

$$u^{(e)} = \sum_{i=1}^{8} N_i u_i \tag{8.119}$$

where N_i, $i = 1(1)8$ are given by (8.118).

Quadratic Lagrange polynomial

We choose twenty nodes on the element (e) as shown in Figure 8.7(c). The approximate function within the hexahedron element is given by

$$u^{(e)}(x, y, z) = \sum_{i=1}^{20} N_i u_i \tag{8.120}$$

where the shape functions N_i in ξ, η, ζ coordinates become, at corner nodes $i = 1(1)8$

$$N_i = \tfrac{1}{8}(1 + \xi\xi_i)(1 + \eta_i\eta)(1 + \zeta_i\zeta)(\xi\xi_i + \eta\eta_i + \zeta\zeta_i - 2)$$

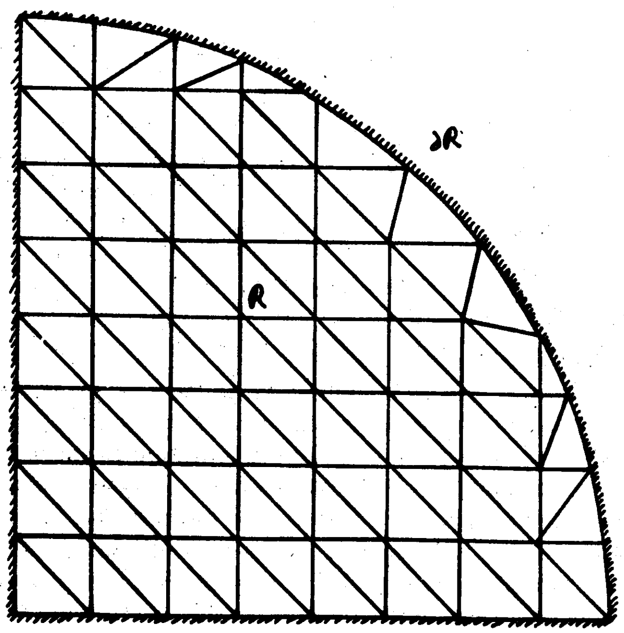

Fig. 8.8(b) Division of domain R with one curved side boundary ∂R

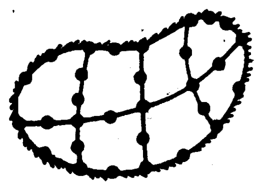

Fig. 8.8(c) Division of domain R with curved-sided elements

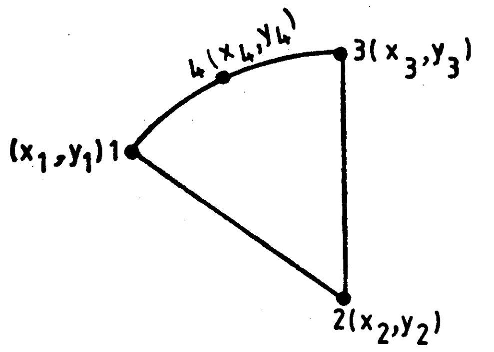

Fig. 8.8(d) Triagular element with one curved side

where the shape functions N_i satisfy the relations

$$N_i(x_j, y_j) = \begin{vmatrix} 1 & i=j \\ 0 & i \neq j, \end{vmatrix}$$

$$\sum_{i=1}^{p} N_i = 1, \tag{8.125}$$