4.6 Exercises

4-5 Three-dimensional element of hexahedron with eight nodes.

(1) Using the equations of shape functions, verify the following properties

$$N_a(\xi_b,\eta_b,\zeta_b)=\delta_{ab}=\begin{cases}1, & a=b\\ 0, & a\neq b\end{cases} \qquad \sum_{a=1}^{8}N_a(\xi,\eta,\zeta)=1$$

(2) Using the equations of shape functions, derive the derivatives

$$\frac{\partial N_a}{\partial\xi},\frac{\partial N_a}{\partial\eta},\frac{\partial N_a}{\partial\zeta},\frac{\partial^2 N_a}{\partial\xi\eta},\frac{\partial^2 N_a}{\partial\eta\zeta}$$

$$\frac{\partial^2 N_a}{\partial\zeta\xi},\frac{\partial^2 N_a}{\partial\xi^2},\frac{\partial^2 N_a}{\partial\eta^2},\frac{\partial^2 N_a}{\partial\zeta^2},\frac{\partial^3 N_a}{\partial\xi\eta\zeta}, \quad a=1,2,\ldots,8$$