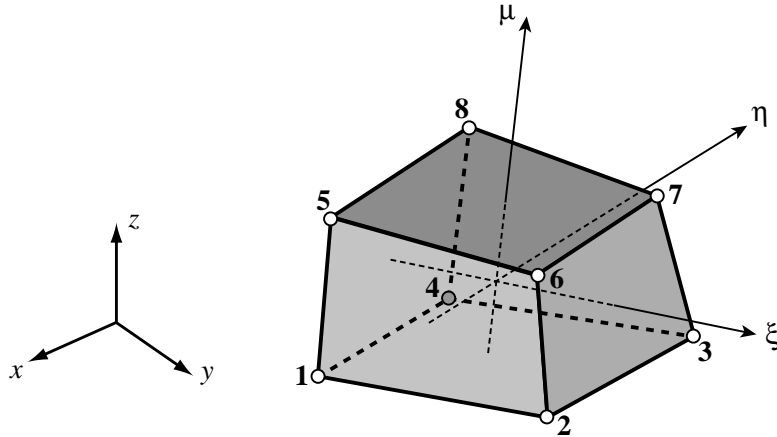


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Hexahedron Elements

The Trilinear (8-Node) Hexahedron



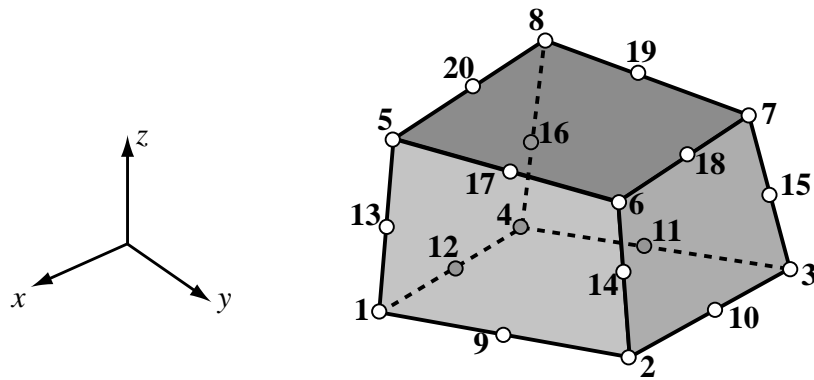
$$\begin{bmatrix} 1 \\ x \\ y \\ z \\ v_x \\ v_y \\ v_z \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ x_1 & x_2 & x_3 & x_4 & x_5 & x_6 & x_7 & x_8 \\ y_1 & y_2 & y_3 & y_4 & y_5 & y_6 & y_7 & y_8 \\ z_1 & z_2 & z_3 & z_4 & z_5 & z_6 & z_7 & z_8 \\ v_{x1} & v_{x2} & v_{x3} & v_{x4} & v_{x5} & v_{x6} & v_{x7} & v_{x8} \\ v_{y1} & v_{y2} & v_{y3} & v_{y4} & v_{y5} & v_{y6} & v_{y7} & v_{y8} \\ v_{z1} & v_{z2} & v_{z3} & v_{z4} & v_{z5} & v_{z6} & v_{z7} & v_{z8} \end{bmatrix} \begin{bmatrix} N_1^{(e)} \\ N_2^{(e)} \\ \vdots \\ N_8^{(e)} \end{bmatrix}$$

The 8-Node Hexahedron Shape Functions

$$\begin{aligned} N_1^{(e)} &= \frac{1}{8}(1 - \xi)(1 - \eta)(1 - \mu), & N_2^{(e)} &= \frac{1}{8}(1 + \xi)(1 - \eta)(1 - \mu) \\ N_3^{(e)} &= \frac{1}{8}(1 + \xi)(1 + \eta)(1 - \mu), & N_4^{(e)} &= \frac{1}{8}(1 - \xi)(1 + \eta)(1 - \mu) \\ N_5^{(e)} &= \frac{1}{8}(1 - \xi)(1 - \eta)(1 + \mu), & N_6^{(e)} &= \frac{1}{8}(1 + \xi)(1 - \eta)(1 + \mu) \\ N_7^{(e)} &= \frac{1}{8}(1 + \xi)(1 + \eta)(1 + \mu), & N_8^{(e)} &= \frac{1}{8}(1 - \xi)(1 + \eta)(1 + \mu) \end{aligned}$$

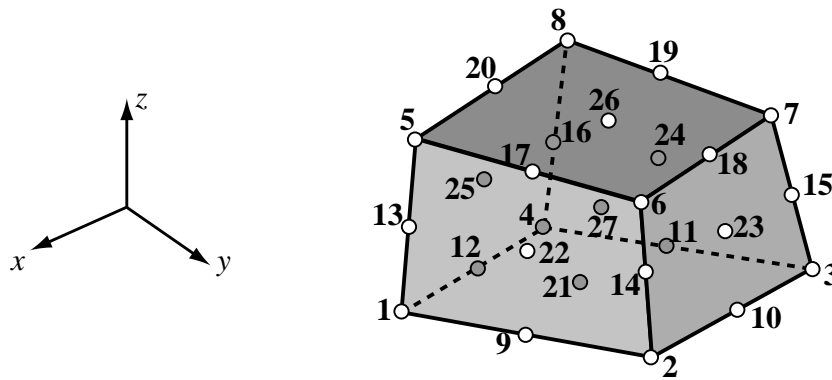
$$N_1^{(e)} = \frac{1}{8}(1 + \xi\xi_i)(1 + \eta\eta_i)(1 + \mu\mu_i)$$

The Serendipity (20-Node) Hexahedron



Shape function slides TBP

The Triquadratic (27-Node) Hexahedron



Shape function slides TBP