AC3D8

This command is used to construct an eight-node 3D brick acoustic element object based on a trilinear isoparametric formulation.

elementAC3D8 $eleTag $node1 $node2 $node3 $node4 $node5 $node6 $node7 $node8 $matTag

$eleTag	unique element object tag
$node1 - $node8	eight nodes defining element boundaries (numbered as shown in the figure below)
$matTag	tag associated with previously-defined nDMaterial object

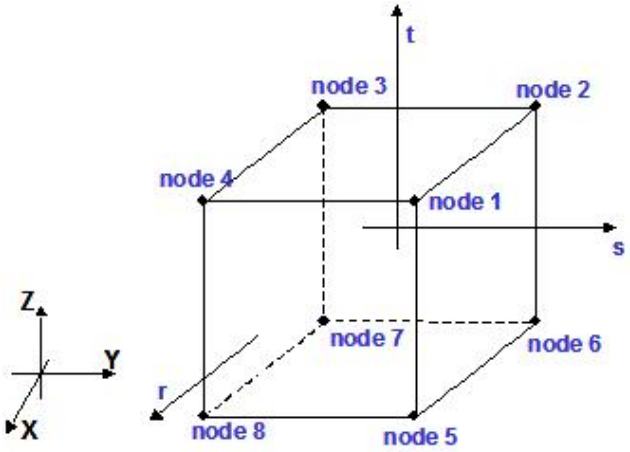

Figure 1.1 Numbering of nodes for the brick element

Formulation

For small motions of a compressible, inviscid and irrational fluid, the excess pressure p in the fluid (the pressure in excess of any static pressure) satisfies the standard scalar wave equation

$$\frac{1}{c^2}\frac{\partial^2 p}{\partial t^2} = \Delta p \tag{1}$$

Where c is the compressive wave velocity in fluid and Δ is the Laplace operator. The discretized finite element equations for Equation (1) is expressed as

$$[M]\{\ddot{p}\} + [K]\{p\} = \{F\} \tag{3}$$

with mass matrix [M], stiffness matrix [K] and right-hand term {F} defined as

$$[M] = \frac{1}{K_f}\int_{V_f} [N]^T [N] dV \tag{4}$$

$$[K] = \int_{V_f} \frac{1}{\rho_f}\left(\frac{\partial [N]^T}{\partial x}\frac{\partial [N]}{\partial x} + \frac{\partial [N]^T}{\partial y}\frac{\partial [N]}{\partial y} + \frac{\partial [N]^T}{\partial z}\frac{\partial [N]}{\partial z}\right) dV \tag{5}$$

$$\{F\} = \int_{S_f} \frac{1}{\rho_f} [N]^T \frac{\partial p}{\partial n} dS \tag{6}$$

in which [N] is the interpolate function matrix, x,y, z are the spatial position of fluid particle, K_f is the bulk modulus of the fluid and ρ_f is the density of the fluid.

Reference

1. ABAQUS theory manual.(2.9.1 Coupled acoustic-structural medium analysis)
2. Gao, Q. Gu, Z. Qiu, Sensitivity Analysis for Seismic Responses of Coupled Dam-Reservoir-Foundation Systems, ASCE Journal of Engineering Mechanics, under preparation.