ISOPARAMETRIC FINITE ELEMENT METHOD TO GENERATE STRUCTURED GRID FOR NUMERICAL FLOW SIMULATION

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Abstract

Eight-nodded quadrilateral finite element is used to generate structured grid for a numerical simulation. The computational domain is sub-divided into number of quadrilateral regions that display the geometry of each sub-domain. The inner and the outer boundaries of the computational domain are described in terms of the surface coordinates. An algebraic homotopy procedure is used to generate grid clustering in order to resolve boundary layer. The structured grid is linked with the flow solver based on finite volume of space discretiztion scheme with multi-stage Runge-Kutta time stepping technique. Examples are illustrated to demonstrate the grid generation procedure and data processing for a forward facing aero-disc spike attached to a hemispherical blunt body at Mach 6 and over a heat shield of a satellite launch vehicle at Mach 0.8 at an angle of attack 5 deg. The present grid generation method is convenient for checking the grid independence test by varying the stretching factor. The quadrilateral grid generated by finite element, vector plot of velocity and contour plots of the computed flow field data are easily drawn with the help of MATLAB.