氫氧超音速火焰之模擬

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摘要

Axisymmetric Navier-Stoke equations coupled with chemical kinetic equations were used to solve the supersonic hydrogen-air combustion solutions. The numerical scheme is based on a central difference with Jameson's artificial viscosity, 4-stage Runge-Kutta time marching algorithm. Three difference chemical kinetic schemes, global 2-step, seven species 7-step, and seven species 8-step were used. The solutions show that seven species 7-step and seven species 8-step are very similar. However, the solution of the global 2-step chemical kinetic provides very little reaction due to the low temperature of the hydrogen jet. The current numerical prediction gives the ignition position at 12.7 diameters downstream. The experimental result shows an ignition position at 8.25 diameters downstream. Also, the numerical solutions show a thinner but stronger distribution of water formation than the experimental data in the radial direction. However, the distribution of nitrogen between the numerical results and experimental results agrees well. Hence, the mass transfer in the simulation is reasonable. Modification of the inlet pressure, inlet Mach number, and grid mesh does not alter the current simulation significantly.

關鍵字：Axisymmetric flow, hydrogen-air flame, equivalence ratio