三維氫氧化學反應流場分析

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摘要

In this study, a three-dimensional Navier-Stokes solver is coupled with finite rate chemistry models. The Navier-Stokes solution algorithm is based on finite volume method using central difference operators. Artificial viscosity is added to avoid numerical instability. Four-stage Runge-Kutta method is used to march the solution to the steady state. The chemical species solution algorithm is also based on finite volume method in which the chemical kinetics and the fluid dynamics are solved in separate steps. The source terms of turbulence model and chemical kinetic models are solved implicitly. The present numerical solutions are validated using the available non-reacting experimental data. The shock structure and H2 mass fraction contours show a good agreement between the measured data and the calculated results. Next, two different finite rate models were used to simulate a reacting situation. The eight-reaction model predicts a much complete reaction of Hydrogen and Air along the shock. The global two-reacting model produces a much slower combustion behind the shock. It seems that the most critical need in the chemical kinetics/fluid dynamic coupling is the correct detailed chemistry models for the present study.

關鍵字：three-dimensional flow solver, finite rate chemistry models, equivalence ratio