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NUMERICAL INVESTIGATION ON NONLIENAR DYNAMIC RESPONSE OF THE RAMJET ENGINE TO FREESTREAM PERTURBATIONS BASED ON WENO SCHEME

Abstract

The perturbation from freestream is inevitable for ramjet, and it will affect the performance of ramjet control system. The dynamic response of ramjet to freestream perturbation is very important for control system. The dynamics of the ramjet engine are represented by one-dimensional unsteady mathematical model with source term, such as friction, mass flow rates and so on. Furthermore, according to the mathematical model, the simulation model of ramjet based on WENO scheme was established. Numerical simulation of ramjet under the perturbation of upstream Mach number, temperature, pressure was carried out. The dynamic responses of the inlet normal shock position, the parameters along duct and effective thrust were obtained, thus the delay time and settle time of such parameters were compared and analyzed. The effect of magnitude of free stream perturbation on dynamic characteristics were acquired, the results show that the settle time slightly varies with the growth of magnitude of perturbation, while the gain varies remarkably with the increase of magnitude of perturbation. The simulation results can be used for control system design and simulation.