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OPTIMUM CONTROL OF RAMJETS AT HIGH FLIGHT MACH NUMBER AND WIDE-RANGE
WORKING CONDITIONS

Abstract

The performance of ramjets is influenced significantly by the quality of the engine control system at high flight Mach numbers. And the performance deteriorates rapidly at non-design point for ramjets working under wide-range conditions without optimized control system. It is possible that a ramjet engine can work always at optimum conditions under changing flight trajectory conditions by means of optimum control. The fuel mass flow rate and nozzle throat diameter are control parameters with practical application meaning. The engine intake can always work at critical or near-critical conditions with the cooperative adjustment between fuel mass flow and the nozzle throat in order to obtain the best engine performance. The critical point to achieve the optimum control is precise detection of the shock wave position or the pressure ratio of the intake. The shock wave probe presented in this paper can be installed downstream of near intake throat section. It can detect the shock wave position rapidly and precisely in corresponding flow-field simulation and wind-tunnel tests. The optimum control can be achieved with the feedback of the shock wave position to the control system to adjust the fuel mass flow and nozzle throat cooperatively.