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ANALYSIS OF A MAGNETO-HYDRO-DYNAMIC (MHD) OBLIQUE DETONATION WAVE ENGINE

Abstract

A novel Magneto-hydro-dynamic (MHD) Oblique Detonation Wave Engine propulsion system is discussed for potential application for hypersonic craft. An MHD generator is used to extract a portion of the aerodynamic heating energy from the inlet and an MHD accelerator to reintroduce this power as kinetic energy in exhaust stream. In this way, the velocity of the combustor entrance can be controlled and the static temperature can be limited to specified value. Thus the fuel and the air can be efficiently mixed and the flight Mach number operating envelope can be extended. For the hypersonic condition, the standing of the oblique detonation wave can be also realized by controlling the velocity of the combustor entrance using MHD. By replacing the standing detonation to the static pressure supersonic combustion, the compressor level of the air inlet is reduced, the thermal cycle effect and thermal capacity is added which improve the propulsion performance. In this paper, the thermal circuit performance analysis model for MHD oblique detonation model is established. The performance estimation of MHD oblique detonation wave engine is carried by changed design point heat method. The comparison for the oblique detonation engine, scramjet, and the MHD oblique detonation wave engine are also showed. It is found that when the enthalpy extraction ration is zero, the upper working limit of the scramjet is lower than the oblique engine. The specific thrust is higher than the oblique detonation wave engine at low Mach number, while the value is lower than oblique detonation engine at high Mach number. The enthalpy extraction ration is increased by using the MHD, therefore, the working range is extended. The effect of MHD characteristics is also considered in the model which is useful to study the MHD oblique detonation wave engine