IAF SPACE PROPULSION SYMPOSIUM (C4)
Hypersonic Air-breathing and Combined Cycle Propulsion (9)

Author: Prof. Sterian Danaila
University POLITEHNICA of Bucharest - Research Center for Aeronautics and Space, Romania,
sterian.danaila@upb.ro

Dr. Dragos Isvoranu
University POLITEHNICA of Bucharest - Research Center for Aeronautics and Space, Romania,
ddisvoranu@gmail.com
Dr. Alina Bogoi
University POLITEHNICA of Bucharest - Research Center for Aeronautics and Space, Romania,
bogoi_alina@yahoo.com
Dr. Constantin Leventiu
University POLITEHNICA of Bucharest - Research Center for Aeronautics and Space, Romania,
cleventiu@yahoo.com

NUMERICAL INVESTIGATIONS ON THE IMPROVEMENT OF BURNING CONDITIONS IN THE SCRAMJET

Abstract

Different to the ramjet solution, the scramjet alternative is confronted with the flame auto-ignition and stability problems during the supersonic combustion. If in the ramjet case, the intake device ensures a configuration of the reflected shock waves such that the terminal shock wave is normal and the flow in the combustion chamber is subsonic, in the scramjet case, the normal shock wave is transformed in an oblique one and the flow stays supersonic downstream the intake device. However, in order to ensure optimal burning conditions, Mach number should remain as low as possible, while the static pressure and temperature have to be kept at their highest values. Not only the extreme values are important but also the uniformity of the distribution of velocity, pressure and temperature fields. The present paper goal is to investigate the possibilities of increasing the efficiency of the intake device (scramjet solution) by controlling the separation zones due to shock waves boundary layer interactions and by reconfiguration of the hole structure of the shock waves system to obtain optimal burning conditions in the combustion chamber. The most important tools of such an endeavor are the distribution of temperature on the walls of the intake/scramjet, injection/suction of air, wall porosity as well as their combinations. The results show that, for example, heating a portion of the intake wall over the adiabatic temperature of the flow leads to a 40The outcomes of this research may lead to the preliminary design of a state-of-the-art intake device for flows with Mach numbers up to 5 with and without incidence.