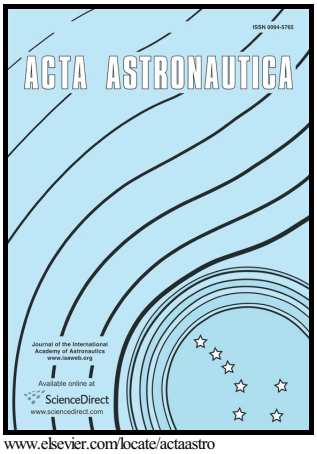

www.elsevier.com/locate/actaastro

Characteristics of Transverse Hydrogen Jet in Presence of Multi Air Jets within Scramjet Combustor

M. Barzegar Gerdroodbary, Keivan Fallah, H. Pourmirzaagha

PII: S0094-5765(16)31009-8
DOI: http://dx.doi.org/10.1016/j.actaastro.2016.11.041
Reference: AA6105

To appear in: *Acta Astronautica*

Received date: 6 October 2016
Accepted date: 27 November 2016

Cite this article as: M. Barzegar Gerdroodbary, Keivan Fallah and H Pourmirzaagha, Characteristics of Transverse Hydrogen Jet in Presence of Mult Air Jets within Scramjet Combustor, *Acta Astronautica* http://dx.doi.org/10.1016/j.actaastro.2016.11.041

Characteristics of Transverse Hydrogen Jet in Presence of Multi Air Jets within Scramjet Combustor

M. Barzegar Gerdroodbary[1*], Keivan Fallah[2], H. Pourmirzaagha[3]

[1]Department of Mechanical Engineering, Babol University of Technology, Babol, Iran
[2]Department of Mechanical Engineering, Sari Branch, Islamic Azad University, Sari, Iran
[3]Department of Mechanical & Aerospace Engineering, Ramsar Branch, Islamic Azad University, Ramsar, Iran
[*]Corresponding author: Tel.: +98 (11) 32334205. mbarzegarg@yahoo.com

Abstract

In this article, three-dimensional simulation is performed to investigate the effects of micro air jets on mixing performances of cascaded hydrogen jets within a scramjet combustor. In order to compare the efficiency of this technique, constant total fuel rate is injected through one, four, eight and sixteen arrays of portholes in a Mach 4.0 crossflow with a fuel global equivalence ratio of 0.5. In this method, micro air jets are released within fuel portholes to augment the penetration in upward direction. Extensive studies were performed by using the Reynolds-averaged Navier–Stokes equations with Menter's Shear Stress Transport (SST) turbulence model. Numerical studies on various air and fuel arrangements are done and the mixing rate and penetration are comprehensively investigated. Also, the flow feature of the fuel and air jets for different configuration is revealed. According to the obtained results, the influence of the micro air jets is significant and the presence of micro air jets increases the mixing rate about 116%, 77%, 56% and 41% for single, 4, 8 and 16 multi fuel jets, respectively. The maximum mixing rate of the hydrogen jet is obtained when the air jets are injected within the sixteen multi fuel jets. According to the circulation analysis of the flow for different air and fuel arrangements, it was found that that the effects of air jets on flow structure are varied in various conditions and the presence of the micro jet highly intensifies the circulation in the case of 8 and 16 multi fuel jets.

Keywords: Supersonic flow; Numerical simulation; Transverse multi jets; Hydrogen jet; Micro air jet