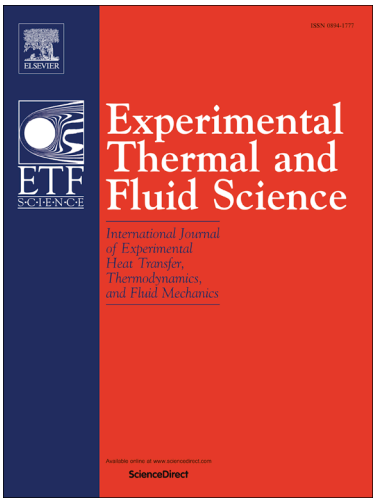

On shock train interaction with cavity oscillations in a confined supersonic flow

Mayank Kumar, Aravind Vaidyanathan

PII: S0894-1777(17)30237-6
DOI: http://dx.doi.org/10.1016/j.expthermflusci.2017.08.009
Reference: ETF 9177

To appear in: *Experimental Thermal and Fluid Science*

Received Date: 15 May 2017
Revised Date: 19 July 2017
Accepted Date: 9 August 2017

Please cite this article as: M. Kumar, A. Vaidyanathan, On shock train interaction with cavity oscillations in a confined supersonic flow, *Experimental Thermal and Fluid Science* (2017), doi: http://dx.doi.org/10.1016/j.expthermflusci.2017.08.009

On shock train interaction with cavity oscillations in a confined supersonic flow

Mayank Kumar[a] and Aravind Vaidyanathan[b]
Indian Institute of Space Science and Technology, Thiruvananthapuram, India

The interaction between shock train and cavity flow oscillations has been investigated experimentally in an open jet facility. Mach 1.71 flow has been passed over a set of rectangular cavities with L/D ratios varying between 5 to 10. Unsteady pressure measurement and schlieren flow visualization is employed to gain insight into the flow physics. Flow visualization reveals the presence of shock train coupled shear layer oscillations at different levels. Confinement variation establishes the importance of cavity depth in affecting the shock train structure, as the increase in the depth resulted in decrease in boundary layer thickness. Shock train strength is found to decrease with decrease in L/D and the weak shock system promotes development of generic cavity oscillations and flow features through longitudinal mechanism. The shock train is found to be oscillatory in nature and the mean position of the bifurcated shock shifts downstream with decrease in L/D. Large scale structures and strengthened oscillations increase the mean and RMS pressure level of the cavities respectively. These large scale structures are incoherent for cavities with hardly any oscillations and coherent for cavities with sustained oscillations. Mode switching and temporal variations in pressure fluctuations are absent for shock train coupled cavity oscillations.

Keywords - supersonic, cavity, wavelet, shock train, boundary layer

[a] Undergraduate, Department of Aerospace Engineering
[b] Associate Professor, Department of Aerospace Engineering. Corresponding author. Tel: +91 471 256 8435. Email address: aravind7@iist.ac.in