Seminar

Institute for Plasma Research

Title : Heat transfer from an impinging jet in presence of inlet oscillations

Speaker : Dr. Harekrishna Yadav
IIT, Mumbai

Date : 28th July 2017 (Friday)

Time : 03.30 PM

Venue : Seminar Hall. IPR

Abstract :

Present work examines pulse jet flow under two conditions: free and impinging, over a wide parameter range. The results have been analysed through novel techniques such as turbulent/non-turbulent interface and processes occurring across this interface; linear stochastic estimate which allows reconstruction of flow field based on a specified event and a large dataset of PIV images. The data has been analyzed in detail through the study of parameters such as variation of centerline velocity, turbulence intensity, Reynolds normal and shear stresses, formation of primary and secondary vortex, vortex strength, phase averaging which allows to explain the repeatability of vortex and its nature and suitable scaling parameter to normalize the wall jet. The results show that: (i) Pulse jet will provided better mixing and heat transfer characteristic over steady jet if operated between $0.14 < St < 0.93$ and will provide maximal effect at frequency corresponding to $St = 0.44$. (ii) The unsteadiness in heat transfer is due to the evolution of primary vortex which is responsible for flow separation (dip in heat transfer) and breakdown of head of primary and secondary vortices leading to flow reattachment at the surface and generation of high turbulence and mixing, which is responsible for appearance of secondary peak in heat transfer distribution. (iii) The frequency of formation of vortical structure was found to be same as the pulse frequency both in the free jet as well as in the impinging jet region and the vortical structure observed along the wall jet are stronger than the corresponding free jet vortical structure. (iv) Laminar impinging jets (both steady and pulse jets) show opposite trend to turbulent impinging jet with change in surface spacing. These results and insights can help in optimizing the pulse jet parameters and will be useful in theoretical modelling of the flow.

Keywords: *Submerged water free and impinging pulse jet, pulsation frequency, pulsation amplitude, turbulent/non-turbulent interface, primary and secondary vortices, flow separation/reattachment, self-similarity, linear stochastic estimation technique, dye visualisation and particle image velocimetry.*