Seminar

Institute for Plasma Research

Title : Numerical study of heat transfer between impinging jets and flat moving surface

Speaker: Dr. Sanil Shah
Institute of Infrastructure Technology Research and Management (IITRAM), Ahmedabad

Date : 23rd June 2023 (Friday)

Time : 03.30 PM

Venue : Seminar Hall, IPR

Abstract:

Impinging jets are most commonly used for heating, cooling, baking, defrosting and drying applications. They produce high local heat transfer in stagnation region and are very useful for spot heating/cooling. They have complex heat transfer mechanism, which become even more complicated when they impinge on moving surface. The study of surface motion on heat transfer is very crucial for several industrial applications. Current work includes numerical analysis of heat transfer by circular jets impinging over a flat moving surface. The analysis is performed for steady and transient cases with the turbulent flow of jet fluid. Local and average heat transfer along with flow field were studied. A two-equation shear stress transport (SST) k-ω model used for solving the Reynolds-averaged Navier–Stokes (RANS) equations of mass, momentum, and energy conservation for incompressible turbulent flow. Various design parameters such as jet exit Reynolds number, jet configurations (inline and staggered), surfaceto-jet velocity ratio (r) etc. are varied. To get idea about local heat transfer, the local Nusselt number (Nu) and an average Nu (Nu_{avg}) are derived. Streamlines are plotted in the corresponding planes to get an idea of the flow field. The results show that the surface motion has a dominant effect on local and average heat transfer at high surface-to-jet velocity ratio (r). A staggered pattern provides more uniform heat transfer as compared to an inline jet pattern. Transient analysis shows that both inline and staggered patterns cool the hot moving plate at the same cooling rate. However, the staggered pattern is cooling the plate more uniformly as compared to the inline jet pattern.

Keywords: *jet impingement, multiple circular jets, turbulence modelling, local heat transfer, flow field*