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Numerical Study of Jet Impingement Heat Transfer

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Abstract : Impinging jets and their different configurations are important from the viewpoint of the fluid flow characteristics and their influence on heat transfer from metal surfaces due to their complex flow characteristics. Such flow characteristics results in highly variable heat transfer from the surface, resulting in varying cooling rates which affects the mechanical properties including hardness and strength. The overall objective of the current research is to conduct a fundamental investigation of the heat transfer mechanisms for an impinging coolant jet. Numerical simulation of the cooling process gives a detailed analysis of the different parameters involved even though employing Computational Fluid Dynamics (CFD) to simulate the real time process, being a relatively new research area, poses many challenges. The heat transfer mechanism in the current research is actuated by jet cooling. The computational tool used in the ongoing research for simulation of the cooling process is ANSYS Workbench software. The temperature and heat flux distribution along the steel strip with the effect of various flow parameters on the heat transfer rate can be observed in addition to determination of the jet impingement patterns, which is the major aim of the present analysis. Modelling both jet and air atomized cooling techniques using CFD methodology and validating with those obtained experimentally- including trial and error with different models and comparison of cooling rates from both the techniques have been included in this work. Finally some concluding remarks are made that identify some gaps in the available literature that have influenced the path of the current investigation.

Keywords : CFD, heat transfer, impinging jets, numerical simulation
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