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NUMERICAL ANALYSIS OF HEAT TRANSFER FROM A HOT PLANE SURFACE DUE TO TURBULENT SWIRLING ROUND JET IMPINGEMENT

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ABSTRACT Detailed numerical investigation of round turbulent submerged swirling jet impingement heat transfer from a heated plane circular surface is conducted. The axisymmetric flow domain is bounded by the hot impingement surface and a concentric circular jet, impinging normally on to the surface. The flow and geometric parameters are the Reynolds number at the jet exit, the swirl number, and the separation distance from the jet exit to the target plate. The computations are performed using the ANSYS FLUENT commercial CFD code using the SST k-ω turbulence model. Various combinations of the flow and geometric parameters are considered and the resulting heat transfer process is critically analysed and the findings are presented. It is observed from the present analysis that swirl negatively affects the heat transfer for the range of jet to target distance and swirl number considered. For any particular separation distance, the local and average Nusselt number distribution shows a decreasing trend with increasing swirl number. The average Nusselt number decreases by 4 to 7% as the swirl number is increased to 0.77.