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Numerical Analysis of Heat Transfer Characteristics of an Orthogonal and Obliquely Impinging Air Jet on a Flat Plate

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Abstract : This research paper investigates the surface heat transfer characteristics using computational fluid dynamics for orthogonal and inclined impinging jet. A jet Reynolds number (R_e) of 10,000, jet-to- plate spacing (H/D) of two and eight and two angles of impingement (α) of 45° and 90° (orthogonal) were employed in this study. An unconfined jet impinges steadily a constant temperature flat surface using air as working fluid. The numerical investigation is validated with an experimental study. This numerical study employs grid dependency investigation and four different types of turbulence models including the transition SSD to accurately predict the second local maximum in Nusselt number. A full analysis of the effect of both turbulence models and mesh size is reported. Numerical values showed excellent agreement with the experimental data for the case of orthogonal impingement. For the case of H/D =6 and α=45° a maximum percentage error of approximately 8.8% occurs of local Nusselt number at stagnation point. Experimental and numerical correlations are presented for four different cases

Keywords : turbulence model, inclined jet impingement, single jet impingement, heat transfer, stagnation point
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