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STEADY VISCOUS FLOW PAST AN ARRAY OF ISOTHERMAL WIRES: EFFECT OF THE BLOCKAGE RATIO ON THE FLOW AND HEAT TRANSFER CHARACTERISTICS

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Abstract. *Two-dimensional steady state computations were carried out for laminar air flow past an infinite side-by-side array of isothermal wires in cross-flow. Using the vorticity-stream function formulation of the Navier-Stokes equations, the governing equations are solved using an appropriate boundary-fitted coordinate system using finite differences. The parameters involved are the non-dimensional blockage ratio defined as the ratio between the wire radius to the wire spacing, ε=a/l, and the Peclet number. This investigation covers a range of Peclet numbers between* 0.072 *to* 28.8 *for blockage ratios of* $0.01 \leq \varepsilon \leq 0.35$. *Results are particularly presented to illustrate the influence of these parameters on the overall flow structure and the non-dimensional heat flux (Nusselt number) from the wire surface. Various comparisons are made with previous theoretical and experimental results to validate the solution methodology, and a new correlation for determining the average Nusselt number as a function of the Peclet number and the blockage ratio that is valid even for very small values of the Peclet number compared to unity has been proposed.*