

Abstract

Turbulent forced convection of a wall jet of thickness H impinging on a two-dimensional obstacle is investigated numerically in this study. The influences of two types of turbulent incoming flows (the wall jet and the channel flow) are studied in order to deepen the understanding of the effect of the wall jet outer layer on the reattachment process and heat transfer over an elongated obstacle. The finite volume method is used to solve the governing equations. In the case of the wall-jet incoming flow, the effect of the nozzle thickness ranging from $H/4$ to $2H$ is examined as a parameter. The obtained results showed that increasing of the thickness of the nozzle improves the heat transfer and considerably modifies the location of the stagnation point. Both turbulence kinetic energy and temperature contours evidence the effect of the external shear layer of the jet. The average obstacle Nusselt number is observed to increase with the Reynolds number ranging from 10,000 to 50,000 and decrease with the augmentation of the thickness of the incoming flow. A correlation is also proposed for the average Nusselt number of the obstacle as a function of the Reynolds number and the obstacle aspect ratio.