

عنوان مقاله:

Study of Conjugate Heat Transfer from Heated Plate by Turbulent Offset Jet in Presence of Freestream Motion using Low-Reynolds Number Modeling

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خلاصه مقاله:

The present study deals with conjugate heat transfer from a heated flat plate by a turbulent offset jet in presence of freestream motion. The turbulent convection in fluid and conduction in solid is solved in a coupled manner by simultaneously satisfying the equality of temperature and heat flux at the solid-fluid interface. The computations have been carried out using low-Reynolds number (LRN) $k-\omega$ SST model in the fluid region. The capability of LRN modeling have enabled to solve the entire boundary layer including the thin viscous sublayer due to which Moffatt vortices (secondary recirculation regions) have been captured near the corner of the wall where the turbulence Reynolds number is low. The bottom surface of solid plate is maintained at a constant temperature higher than the jet inlet temperature whereas the jet inlet temperature is same as that of the ambient. The present investigation reports the effects of offset ratio of jet (OR), Reynolds number of flow (Re), solid to fluid thermal conductivity ratio (K), solid slab thickness (S) and freestream velocity (U_∞) on conjugate heat transfer arises due to solid and fluid interaction. The offset ratio is varied in the range $OR = 3 - 11$, Reynolds number in the range $Re = 10000 - 25000$, solid to fluid thermal conductivity ratio in the range $K = 1 - 2000$, solid slab thickness in the range $S = 1-20$ and freestream velocity in the range $U_\infty = 0.1 - 0.25$. The effects of various parameters on the near-wall velocity profile, solid-fluid interface temperature, local Nusselt number variation along the plate, heat flux variation along the plate, etc. have been discussed in detail.

کلمات کلیدی:

Conjugate Heat Transfer, Offset jet, Low, Reynolds number model, Freestream motion, Numerical simulation

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