Abstract

The use of lightweight,heavyduty ' compact heat exchangers' in the process industries has necessitated increasing research into the mechanics of fluid flow and heat transfer in the laminar flow regime, since the flow conditions in these heat exchangers are essentially laminar. In majority of the cases, the geometry of these ducts is non-circular in nature. Although fluid flow and heat transfer solutions have been chronicled for the entire gamut of non-circular ducts, using a variety of techniques, definition of Reynolds number on the basis of the duct width has never been attempted before. Flow friction and heat transfer solutions have been presented for a variety of system parameters, using the duct width as the defining standard for the flow Re.

Forced convection across an isolated obstacle and across an array of obstacles is studied. To the knowledge of the authors, very little work has been done in the area of numerical analysis of forced convection across three-dimensional obstacle bodies. The duct width, and not the obstacle width is used for defining the Reynolds number. This is done because the objective is primarily to determine the effect of the obstacle position on the drag, and to determine the wall effects, rather than to highlight the effect of blockage ratio. The effect of the obstacle on the upstream flow conditions is discounted. Therefore, the velocity is non-dimensionalized with respect to the free-stream velocity.