

Numerical Analysis of Laminar Mixed Convection Inside a Vertical Plate Channel with Corrugated Side Walls

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Abstract

A numerical study of laminar mixed convection heat transfer inside a vertical plate channel has been carried out to investigate the effect of side wall corrugation on the thermal and fluid flow characteristics. Two different types of corrugation such as sinusoidal and triangular shapes are considered in the present analysis. The working fluid is assumed to be air having incompressible, single-phase, laminar flow through the channel. Two-dimensional Navier-Stokes and energy equations are considered as the governing equations of the current problem. In order to solve this problem, the finite element method is applied to discretise these equations along with the appropriate boundary conditions. The numerical results are obtained for a wide range of governing parameters such as Grashof number, Reynolds number and Richardson number. A comparison of results for two different type of corrugated channels with the smooth wall channel is also presented. The computational result reveals that the heat transfer outstandingly increases due to the presence of corrugation. Moreover, with the change of different governing parameters, the heat transfer also gets changed significantly.

Keywords

Channel flow, Richardson number, Finite element method, Isoflux heating, Sinusoidal corrugation.

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Biographies

Tamanna AkterJui received her B.Sc. in Mechanical Engineering from Bangladesh University of Engineering and Technology (BUET) on 2019. Her research interest involves computational fluid mechanics, computational heat transfer and molecular dynamics. She has already published two research papers in international conference proceedings.

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Dr. Sumon Saha received his PhD in Engineering from the University of Melbourne, Victoria, Australia in 2014. He completed his B.Sc. and M.Sc. in Mechanical Engineering from Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh on 2004 and 2007, respectively. His major field of study is numerical analysis on problems of thermo-fluid. He is now working as an Associate Professor in the Department of Mechanical Engineering of Bangladesh University of Engineering and Technology (BUET). He already published more than 130 research papers in International Journals and Conference Proceedings and coauthor of two books in engineering field. His fields of interests are turbulent flows, computational fluid mechanics, computational heat

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