International Journal of Mechanical Engineering (IJME)
ISSN(P): 2319-2240; ISSN(E): 2319-2259
Vol. 3, Issue 3, May 2014, 13-36

International Academy of Science, Engineering and Technology
Connecting Researchers; Nurturing Innovations

MIXED CONVECTION IN TWO-SIDED PARALLEL AND OPPOSITE LID-DRIVEN DIFFERENTIALLYHEATED PARALLELOGRAMMIC CAVITY

MOHAMMED YOUSIF JABBAR

Department of Mechanical Engineering, College of Engineering, Babylon University, Babylon, Iraq

ABSTRACT

Mixed convection in a two-sided parallel and opposite lid-driven differentially heated parallelogrammic cavity has been investigated and solved numerically using the finite volume method. The top and bottom walls of the cavity are horizontal and thermally insulated, whereas the left and right moving walls are maintained at different hot and cold constant temperatures, respectively. Two different orientations of the wall movement have been considered depending on the direction of moving walls, and then four cases are considered. Calculations have been made for a wide range of Richardson numbers from 0.01-100 and various side wall inclination angles with gravitational direction ($-60^o \leq \Phi \leq 60^o$). Effort is focused on the interaction of forced convection with natural convection. The working fluid is air, so that the Prandtl number equals to 0.71. Flow and heat transfer characteristics inside the cavity have been presented and discussed in terms of streamtraces, isotherms and local and average Nusselt number along the cold and heated walls for various combinations of different governing parameters. The accuracy of the numerical method is checked by comparisons with previously published works and the results showed an excellent agreement. The obtained results showed that the positive values of Φ cause a greater increase in local Nusselt number than the same negative values of Φ, and both of them have great effects on the heat transfer phenomenon.

KEYWORDS: Mixed Convection, Two-Sided, Lid-Driven, Parallelogrammic Cavity, Parallel or Opposite Motion, Finite Volume