

Abstract

This is a numerical study of turbulent natural convection flow in a rectangular enclosure. The flow of heat is one form of Newtonian motion. We consider natural convection in a three dimensional rectangular enclosure in the form of a room with heaters placed on opposite walls and two windows each on the adjacent opposite walls. The study of free convection in the past five decades focused mainly on two different simple geometries, first the single isothermal or constant flux vertical plate in isothermal stagnant surrounding, secondly, the enclosed rectangular cavity with heated floor and cooled walls. There has also been much emphasis on Rayleigh number as opposed to the Reynolds number used in this study. To analyze the flow and heat transfer rates, a complete set of non-dimensionalized equations governing Newtonian fluid and boundary conditions are recast into vector potential to eliminate the need for solving the continuity equations. A Boussinesq fluid motion in a three dimensional cavity is considered. The governing equations with the boundary conditions are discretized using three point central difference approximations for a non-uniform mesh. The resulting finite difference equations are solved using Matlab simulation software. The solutions are presented at the Reynolds number 5500, with Prandtl number 0.71. The results are presented on graphs to show velocity profiles and temperature distribution in the room. The room is divided into a number of regions with those near the heaters having high temperatures as those near the windows have low temperatures. Convective.