Effect of temperature gradient orientation on the characteristics of mixed convection flow in a lid-driven square cavity

鄭藏勝,柳文祥
Mechanical Engineering
Engineering
tscheng@chu.edu.tw

Abstract

The effect of temperature gradient orientation on the fluid flow and heat transfer in a lid-driven differentially heated square cavity is investigated numerically. The transport equations are solved using the high-order compact scheme. Four cases are considered depending on the direction of temperature gradient imposed. The differentially heated top and bottom walls result in gravitationally stable and unstable temperature gradients. While the differentially heated left and right side walls lead to assisting and opposing buoyancy effects. The governing parameters are Pr = 0.7 and Ri = 0.1, 1, and 10. It is found that both Richardson number and direction of temperature gradient affect the flow patterns, heat transport processes, and heat transfer rates in the cavity. Computed average Nusselt number indicates that the heat transfer rate increases with decreasing Ri regardless the orientation of temperature gradient imposed. And the assisting buoyancy flows have best performance on heat transport over the other three cases.

Keyword：Mixed convection; Lid-driven cavity; Temperature gradient; High-order compact scheme