RESONANCE OF VERTICAL BOUNDARY LAYER FLOW BY A SIDE WALL THERMAL OSCILLATION IN AN ENCLOSURE

Seo Young Kim[*] and Sung Ki Kim[**]
[*]Thermal/Flow Control Research Center, Korea Institute of Science and Technology
P.O. Box 131, Cheongryang, Seoul, 130-650, South Korea
[**] R&D team, Visual & Display Division, Samsung Electronics, South Korea
[*]Correspondence author. Fax: +82 2 958 5683 Email: seoykim@kist.re.kr

ABSTRACT A numerical study has been conducted to investigate the amplification of boundary layer instability in a side-heated enclosure with a thermal oscillation of vertical hot wall. The impetus of the present study is to investigate the influence of hot-wall thermal oscillation, in which the imposing frequency is one order-of-magnitude higher than that of the internal gravity wave, on the fluctuation characteristics of boundary layer flow and internal flow in an enclosure. The numerical results show that the intensity of fluctuation of boundary layer flow is augmented and the internal flow in the cavity core is substantially influenced when the wall thermal oscillation is in tune with the characteristic frequency of boundary layer instability. For the wall thermal oscillation of the characteristic frequency, the modulated frequency fluctuations appear in the corner region due to the flow interaction between the vertical boundary layer flow and the wall jet along the horizontal walls. The amplified fluctuation of boundary layer flow affects time-averaged heat transfer rate. The maximum enhancement in the Nusselt number is also obtained for the wall thermal oscillation nearly matched with the boundary layer instability frequency.