عنوان مقاله:

On the Effect of Aspect Ratio of Open Heated Channel Including an Active Obstacle upon the Turbulent Characteristics of a Thermal Plume: Experimental Analysis

محل انتشار:

دوماهنامه مکانیک سیالات کاربردی, دوره 9, شماره 6 (سال: 1395)

تعداد صفحات اصل مقاله: 11

نویسندگان:

T. Naffouti - *Université Tunis El-Manar, Faculté des Sciences de Tunis, Département de Physique, Laboratoire d'Energétique et des Transferts Thermique et Massique, El Manar ۲۰۹۲, Tunis, Tunisia.*

J. Zinoubi - *Université Tunis El-Manar, Faculté des Sciences de Tunis, Département de Physique, Laboratoire d'Energétique et des Transferts Thermique et Massique, El Manar ۲۰۹۲, Tunis, Tunisia.*

R. B. Maad - *Université Tunis El-Manar, Faculté des Sciences de Tunis, Département de Physique, Laboratoire d'Energétique et des Transferts Thermique et Massique, El Manar ۲۰۹۲, Tunis, Tunisia.*

خلاصه مقاله:

This paper reports an experimental investigation of aspect ratio effect of open vertical channel on turbulent characteristics of a thermal plume. The physical configuration is constituted essentially by a prallelepipedic channel and an obstacle of a rectangular section. The thermal plume is generated by a rectangular obstacle heated uniformly at the upper surface. This active source is placed at the entry of a vertical channel open at the ends. The symmetrical heating of channel walls by joule effect and by thermal radiation emitted by the plume, causes the appearance of a thermosiphon flow which interacts with this one. To investigate the flow fluctuations, an anemometer at constant current (CCA) is used. The results carried out with air (Pr = ۰.۷۱) are performed for Rayleigh number equal to ۰.۶۳ ۱۰۷ over a wide range of aspect ratio ۱.۲۵ ≤ A ≤ ۳۰. Effects of this pertinent parameter are displayed upon thermal and dynamic turbulent fields. Using Taylor hypothesis, time and length scales of turbulent thermal field are studied. It is found that the turbulent characteristics of the flow are significantly influenced by the variation of aspect ratio. An optimum aspect ratio of channel characterized by a strong homogenization of turbulence of the flow is observed. The fine analysis of temperature fluctuations spectra shows the evolution of the vortices in energy cascade owing to the strong effect of thermosiphon flow which favours the vortex stretching.

کلمات کلیدی:

Optimum aspect ratio, thermal plume, Thermosiphon flow, Turbulence scales, Power spectral density, spectral laws