ISSN: 2277-9655
Impact Factor: 1.852

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

Review Study of Natural Convection Heat Transfer on Heated Plate by Different Types of Fin Array

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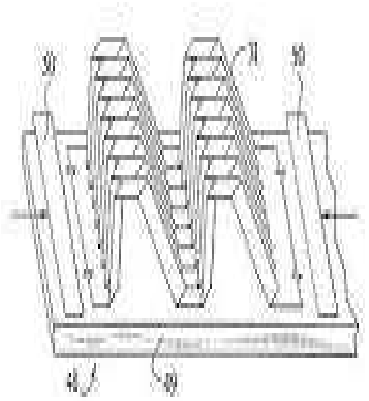
Abstract

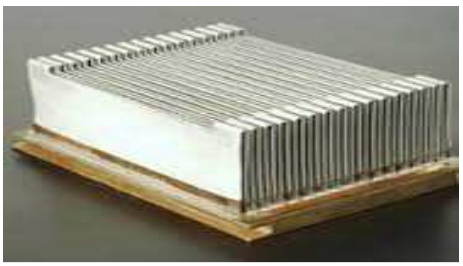
Fins are also called as extended surfaces the main purpose of that is to increase the heat transfer rate Fins offer an economical and trouble free solution in many situations demanding natural convection heat transfer. This fins are use for many applications such as variety of engineering applications, studies of heat transfer and fluid flow associated with such arrays are of considerable engineering significance. Geometry of fin arrays play an important role in heat transfer rate for that different types of fin arrays are used such as rectangular, circular, triangular and trapezoidal are used. This study may be carried out with notch and without notch by using different types of material many researcher works on the fins by different experimental setup to study the effect of natural convection In this review paper, the main objective of this paper is to give brief overview of enhance heat transfer rate with the help of perforated fins till.

Keywords: Fine Array, Natural convection.

Introduction

Fins are extensively used in air cooled automobile engines, air craft engines, cooling of generators, motors, transformers, refrigerators, cooling of computer processors and other electronic devices etc. Previously, a great number of experimental and numerical works has been carried out to study the effect of fin parameters like fin height, fin spacing etc. on heat transfer rate from fin array by the investigators. The active heat transfer enhancement techniques have not found commercial interest because of the capital and operating cost of the enhancement devices. Enhancement of heat transfer is of vital importance in many industrial applications. One of the methods of enhancing heat transfer is the use of extended surfaces or fins. Extended surfaces are used to enhance heat transfer in a wide range of engineering applications and offer a practical means for achieving a large total heat transfer surface area. Fins are commonly applied for heat management in electrical appliances such as computer power supplied, or other applications include IC engine cooling such as fins in a car radiator.





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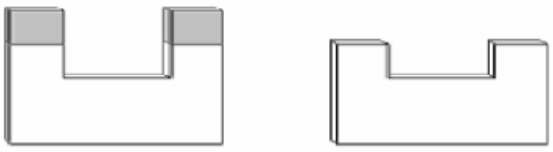
Review Work Carried

As the fins are very important parts to enhance the heat dissipation rate so it is necessary to study by considering various parameters it may be theoretical or by experiments,

Baskaya et al (2000) [1] carried out parametric study of natural convection heat transfer from the horizontal rectangular fin arrays. They investigated the effects of a wide range of geometrical parameters like fin spacing, fin height, fin length and temperature difference between fin and surroundings; to the heat transfer from horizontal fin arrays. However, no clear conclusions were drawn due to the various parameters involved. Finally they concluded that, it is not possible to obtain optimum performance in terms of overall heat transfer by only concentrating on one or two parameters.

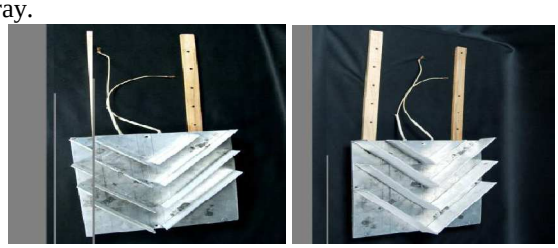
Yunus A. Çengel [2] in analysis of fins we consider steady operation with no heat generation in the fin & assume thermal conductivity of material is constant. As Fins are generally used to increase the heat transfer rate from the surface The heat transfer coefficient is assumed to be constant over the entire surface of the fin. The value of h is much lower at the base than its tip. Because fluid is surrounded by the solid surface near its base. Hence adding too many fins on a surface decrease the overall heat transfer coefficient when the decrease in h offsets any gain resulting from the increase in the surface area.

Senol Baskaya & Murat Ozek[3] works by using aluminum material for his parametric study They studied each of the variables of fin spacing, height, and length and temperature difference produces an effect on the overall heat transfer rate They investigated the effects of a wide range of geometrical parameters like fin spacing, fin height, fin length and temperature difference between fin and surroundings; to the heat transfer from horizontal fin arrays. However, no clear conclusions were drawn due to the various parameters involved. Finally they concluded that, it is not possible to obtain optimum performance in terms of overall heat transfer by only concentrating on one or two parameters.



S.H.Barhatte, M.R.Chopade, and V.N.Kapatkar[3] works on different types of fin array such as rectangular, circular, triangular and trapezoidal. They compare without notch and notch fin array by supplying different heat inputs. The dimensions of fin were fixed. They concluded that more heat is transfer through triangular notch fin.

M.J. Sable1, S.J. Jagtap2 , P.S. Patil 3 , P.R. Baviskar4 & S.B. Barve5[4] Nov.2010, works on the ENHANCEMENT OF NATURAL CONVECTION HEAT TRANSFER ON VERTICAL HEATED PLATE BY MULTIPLE V-FIN ARRAY, their investigation work a totally new heat transfer technique is found out to increase the rate of natural convection heat transfer on vertical heated plate. The V –type fin array can be seen as the combination of a horizontal and vertical partition plates. For the same surface areas, V-type partition plates gave better heat transfer performance than vertical rectangular fin array and V-fin with bottom spacing type array.



V-fin array with bottom spacing (20mm) V-fin array (Fin height = 20mm)

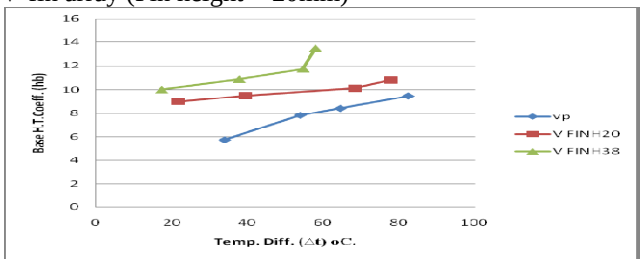


Fig. : Variation of (hb) Vs (Δt)oc for V-fin array

Sanjeev D. Suryawanshi1 & Narayan K. Sane,in AUGUST 2009, Vol. 131, Department of Mechanical Engineering, SSVPS's BSD Polytechnic, Dhule[5] works on the , Natural Convection Heat Transfer From Horizontal Rectangular Inverted Notched Fin Arrays The variables for natural convection cooling with the help of finned surfaces are orientation and geometry. In lengthwise short array _L/H_5_, where single chimney flow pattern is present, a stagnant zone is created at the central bottom portion of fin array channel and hence it does not contribute much in heat dissipation. Hence it is removed I the form of inverted notch at the central bottom portion of fin to modify its geometry for enhancement of heat transfer. An experimental setup is developed for studying the investigation on normal and inverted notched fin arrays (INFAs) it is verified by computational fluid dynamics analysis. It is found that the average heat transfer coefficient for INFAs is nearly 30–40% higher as compared with normal array.

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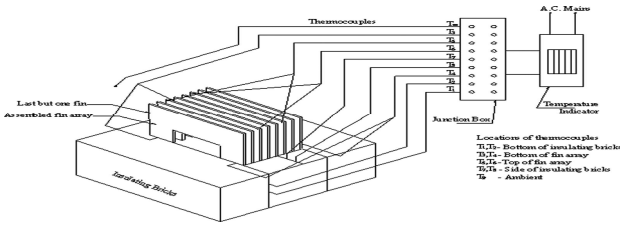
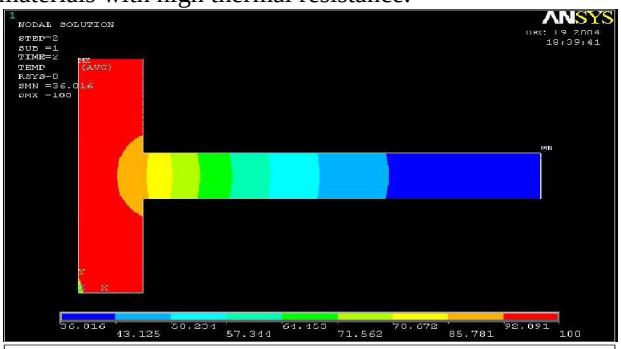
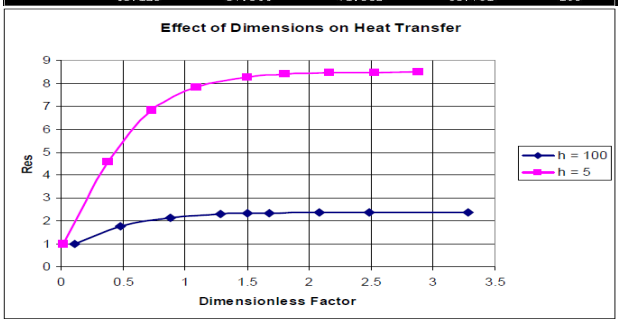


fig. Experimental setup with thermocouple locations

In December 20, 2004 Matthew Christensen[6] works on the Static Heat Transfer analysis of Fins, for the analysis he considered a plate with fin & without fin, and he compared them, It was determined that fins are extremely effective in situations where Heat Transfer Coefficients (h) is low, but as h rises the effect of a fin will decrease. The thermal resistance of the material is also very important. Fins are very effective on materials with a low thermal resistance, but are less effective on materials with high thermal resistance.





Study made by M.R. Shaeri, M. Yaghoubi, K. Jafarpur[7] Three dimensional numerical computations is made for turbulent fluid flow and convective heat transfer around and array of rectangular solid and new design of perforated fins with different numbers and two various sizes of perforations. Experiments were conducted for the range of Reynolds number from 2000 to 5000 based on fin thickness and PR=0.71. For fins with perforations the region of recirculation over the faces of perforated fins at a fixed altitude of fin is different than solid fin, but this region over the top surface of fins is nearly the same for all types of fins studied. With increase of perforations flow becomes completed average friction coefficient decrease and solid fin has the highest value of cf. for fins with perforations, drag force reduces. Also drag ratio becomes smaller by increasing Reynolds number. Average Nusselt number decrease by increasing perforations solid fin has the largest average Nusselt number for each Reynolds number for practical application.

Study made by Se kyung Oh, Ary Bachitar Krishna Putra, and Soo whan Ahn[8] .The characteristics of fluid flow and heat transfer in a rectangular channel with single inclined baffle and the low flow Reynolds number is varied between 23000 and 57000 are numerically and experimentally investigate. Numerical prediction of the flow fields, and isotherms depicts that each baffle has a different transport phenomenon. This solid type (type I) baffle channel has the highest friction factor due to more flow blockage. The Nusselt number is greatest at baffle type II.

Conclusion

As the fins are very important part hence its study is very important for improved design and also improving the heat dissipation rate performance of the plate by using different fin geometry and fin array also by other parameters such as fin height, fin spacing, This concept is followed by number of researches for their application. But still lot many work remains to be carried out in the future. This paper provides the background of fin to carried out further research work in future.

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