ENHANCEMENT OF HEAT TRANSFER THROUGH DIFFERENT TYPES OF FINS

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INTRODUCTION:
Natural convection heat transfer in a fluid layer confined in a closed enclosure with partitions like fins is encountered in a wide variety of engineering applications. Such as in power and automotive sectors where heat exchangers, economizers used to heat the feed water to boiler and the activities like cooling of internal combustion engine, also removal of heat from integrated circuits in the electronic circuits or exchange of heat between two fluids as in nuclear power plants, passive cooling of electronic equipment such as compact power supplies, portable computers and telecommunications enclosures. In the design of electronic packages, there are strong incentives to mount as much electronic components as possible in a given enclosure. This leads to high power generation density and this may rise the temperature of the packages above the allowable limit. Therefore there is need to increase heat transfer rate for working a device at designed efficiency.

Many researchers have been mentioned through their literature, heat transfer rate is increased by increasing heat transfer coefficient or by heat transfer area. In case of natural convection there is only scope for increasing heat transfer area by providing finned surfaces. The enhancement ratio of heat transfer depends on the fins orientations and the geometric parameters of fin arrays. The most common configurations of using fin arrays in heat sinks involve horizontal or vertical surface plate to which fin arrays are attached.

OBJECTIVE:
1. Understand the meaning of extend surface or fin.
2. Familiarize him or her with the types of fin in common use.
3. Analyze the heat transfer through fins of uniform cross section.
4. Determine the temperature distribution and heat transfer through an infinitely long pin.
5. Predict the temperature distribution and heat transfer through a fin of finite length with insulated end.
6. Calculate the temperature distribution and rate of heat transfer through a fin of finite length with heat losses through the end.
7. Define and calculate fin efficiency
METHODOLOGY:
DIFFERENT TYPES OF FINS

Literature review
**Abdullah, H. Alessa:** studied the natural convection heat transfer enhancement from a horizontal rectangular fin embedded with equilateral triangular perforations. He concluded that, For certain values of triangular dimensions, the perforated fin can result in heat transfer enhancement. The magnitude of enhancement is proportional to the fin thickness and its thermal conductivity. The perforation of fins enhances heat dissipation rates and at the same time decreases the expenditure of the fin material.

**B.Ramdas Pradip:** He studied the many industries are utilizing thermal systems wherein overheating can damage the system components and lead to failure of the system. In order to overcome this problem, thermal systems with effective emitters such as ribs, fins, baffles etc. are desirable. The need to increase the thermal performance of the systems, thereby affecting energy, material and cost savings has led to development and use of many techniques termed as “Heat transfer Augmentation”. This technique is also termed as “Heat transfer Enhancement” or “Intensification”.

Augmentation techniques increase convective heat transfer by reducing the thermal resistance in a heat exchanger. Many heat augmentation techniques has been reviewed, these are (a) surface roughness, (b) plate baffle and wave baffle, (c) perforated baffle, (d) inclined baffle, (e) porous baffle, (f) corrugated channel, (g) twisted tape inserts, (h) discontinuous Crossed Ribs and Grooves. Most of these enhancement techniques are based on the baffle arrangement.

Use of Heat transfer enhancement techniques lead to increase in heat transfer coefficient but at the cost of increase in pressure drop.

**Golnoosh Mostafavi:** He investigated the steady-state external natural convection heat transfer from vertically mounted rectangular interrupted finned heat sinks. After regenerating and validating the existing analytical results for continuous fins, a systematic numerical, experimental, and analytical study is conducted on the effect of the fin array and single wall
interruption. FLUENT and COMSOL Multiphysics software are used in order to develop a two dimensional numerical model for investigation of fin interruption effects. Results show that adding interruptions to vertical rectangular fins enhances the thermal performance of fins and reduces the weight of the fin arrays, which in turn, can lead to lower manufacturing costs.

Sable M.J: He investigated for natural convection adjacent to a vertical heated plate with a multiple v-type partition plates (fins) in ambient air surrounding. As compared to conventional vertical fins, this v-type partition plate’s works not only as extended surface but also as flow turbulator. In order to enhance the heat transfer, V-shaped partition plates (fins) with edges faced upstream were attached to the two identical vertical plates. They observed that among the three different fin array configurations on vertical heated plate, V-type fin array design performs better than rectangular vertical fin array and V-fin array with bottom spacing design. The performance was observed to improve further, with increase in the height of the V-plates (fin height)

Methodology to increase the heat transfer rate:
1. By increasing the surface area in contact with air or providing fins.
2. By increasing the heat transfer coefficient for the surface.
3. By increasing the temp of the hot surface or by increasing the temperature difference between hot and cold bodies.

CONCLUSION:

The experimentation procedure and the analytical calculations has been successfully and define the value of HTC for notched fins, by experimentation and calculation it has been found that fin with rectangular notch has HTC(heat transfer co efficient).

<table>
<thead>
<tr>
<th>Fins with Notches</th>
<th>Heat Transfer Coeff. (h) w/m²k</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triangular</td>
<td>7.161</td>
</tr>
<tr>
<td>Rectangular</td>
<td>7.137</td>
</tr>
<tr>
<td>Circular</td>
<td>7.107</td>
</tr>
<tr>
<td>Trapezoidal</td>
<td>7.105</td>
</tr>
<tr>
<td>Without Notch</td>
<td>7.097</td>
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</tbody>
</table>
FUTURE WORK:

1. By providing notches over the fins of engines vehicles to increase the rate of heat transfer.
2. Incorporating the notches in radiators so that faster cooling rate can be achieved.