CHAPTER (1)
INTRODUCTION

1.1 General

The main aim of heat transfer analysis is to create a thermo-fluid environment, yielding to an optimum value of heat transfer coefficient. High values of heat transfer coefficient are desirable for a proper heat exchanger, since less surface area is required for a given total heat transfer rate with fixed wall and fluid temperatures. Energy and materials saving considerations as well as economic motives have led to several efforts to produce higher efficient heat exchanger. This can be achieved either by reducing the size of such heat exchanger required for a specified heat load or by enhancing the capacity of the heat exchanger. Efficient heat transfer might also be useful to prevent excessive temperatures or even system destruction, in systems where heat generation rates are fixed.

Heat transfer enhancement, which means an increase in heat transfer coefficient, has several techniques. Enhancement techniques may-be classified as passive techniques, which do not require external power, and active techniques, which require external power.

Passive techniques comprise the use of ribbed surfaces, extended surfaces, baffled flow, swirled flow, fluid additives, porous media, rib lets. Active techniques include surface vibration, fluid vibration and injection. Primarily, there are three popular techniques to enhance heat transfer in channels. The first type is the boundary layer disturbance that is created by periodically placed ribs on the heat transfer surface. The second is the impinged cooling that uses high velocity jets to cool the surface of interest. The last one is the internal flow swirls or tape twisters that create a significant amount of bulk flow disturbance.

Since the heat transfer coefficient of gases flowing in ducts is relatively low, it is advisable to use some kind of turbulence promoters. Like jet impingement, ribs and other heat transfer enhancement techniques, the insertion of baffles in heat transfer devices, is a popular technique to promote better mixing of the coolant and increase the cooling performance.

The placement of baffles on the duct walls interrupts the development of the boundary layers, causing the flow to separate at fixed edges, creating a recirculation zone downstream. The recalculating eddy carries the near-wall fluid to the edge of the core flow and then diffuses away the heat. Also, the separation caused by the baffles, creates reversed flow regions of high mixing and turbulence generation. Furthermore, the baffles provide additional surface area for heat transfer, so the mixing process of the flow as well as the existence of additional surface improves the heat transfer coefficients.

Series of baffles may be employed in many engineering and industrial applications. They are used in different types of heat exchangers, such as shell-and-tube heat exchangers that are used as coolers and condensers in large scale system as shown in Fig 1.1.