Good literature review on experimental studies on heat transfer characteristics o...

Health & Medicine, Stress

Literature review

Heat transfer and friction characteristics in a square duct roughened by various shaped ribs on one wall [Aliaga, b, 1994]. Liquid crystal thermograph is used to measure local and average heat transfer coefficient of ribbed surface. The ribs height to duct hydraulic diameter ratio is fixed to 0. 1. The rib pitch to height ratio varies from 8 to 15 and Reynolds number spans from 8000 to 20, 000[Aliaga, b, 1994]. The experiment consists of heat transfer test and pressure test. The test experiment consists of 750mm long smooth duct followed by a rib-roughened section of equal length. Plexiglas plates are applied to provide optical access for liquid crystal measurement. The Income foil is produced to apply uniform heat flux on one wall [Aliaga, b, 1994]. The measurement is in the inlet of the duct. a pre-packed liquid crystal sheet R35C5W backed with pressure sensitive adhesive to map the temperature on the ribbed surface. Before the experiment the liquid crystal is calibrated with the temperature and hue value. The hue is linear with the temperature value 30 to 150 with the temperature corresponding to the range of 30 to 37. 5. When mapping the inner rib local heat transfer for P/E= 12 and Re= 20, 000 the trapezoidal-shaped ribs having X/e= 1, high friction loss; whereas the trapezoidal X/e= 2 or 3 having lowest pressure drop. For the Reynolds number studied, the trapezoidal-shaped with decreasing height in the flow direction having highest heat transfer coefficient and friction factor; with increase in height having drop in pressure in less heat transfer and also the square shaped ribs and triangular ribs having nearly same heat transfer and friction[Aliaga, b, 1994]. The thermal performance is always varies with the rib shape. The local hotspot is always depending on the ribs shapes

[Promvonge, P, 1998].

Enhanced heat transfer is a flat rectangular duct with stream wise-periodic disturbances at one principal wall [Promvonge, P, 1998]. In this study the performance with a flat rectangular duct to determine the heat and pressure drop response. In this experiment there will be a periodic disturbance which shows better result when compared to the smooth walled duct and also the friction factor is several times greater than the smooth duct valves. They having two principle walls the upper part are an aluminum block and the lower part is furnished with naphthalene the two side walls which act as spaces between the principle walls. Small diameter cylindrical rods are situated above the lower walls [Promvonge, P, 1998]. Then the lower wall is coated with the oil lampblack which was covered with white contact paper to provide high contrast. The disturbance rods were positioned adjacent to the lower wall and other rods adjacent to the upper wall [Promvonge, P, 1998]. A stream wise traversal is made along with three parallel lines aligned with the flow direction. One line midway between side walls is another half way between the midline and side wall other in the midline. The evaluations were recorded at 160 equally spaced points. In the result the local Sherwood number distributed in the lower graph shows all points and the upper graph shows every fourth point. It describes the main feature of the Sherwood the pressure drop is not in the straight line. They provided definite information about the heat transfer and pressure drop by cylindrical rods placed adjacent to the principle wall. They defined the boundary conditions in thermal terms show the uniform temperature at the rodded wall and no heat transfer at the smooth wall and also the same uniform temperature at both walls. The highly detailed local Sherwood numbers were obtained and cyclic development regime was obtained [Sparrow, 1993]. The mass transfer Sherwood number was encountered. This shows the friction factor were several times larger than those for the smooth wall case

Internal communication in heat and mass transfer represent the turbulent heat transfer and friction loss behavior of airflow through contrast heat fluxed channel fitted with different height of triangular ribs [Sparrow, 1993]. Two ribs arrangement inline and staggered array were produced. They have a rectangular channel aspect ratio= 10 height= 30 three uniform ribs and a non-uniform ribs. The flow rate is 5000 to 22, 000. The uniform performance is better than the non –uniform one for the cooling channel the ribs were placed to passive heat transfer in single phase internal flows [Sparrow, 1993]. The periodical and positioning ribs in the channel interrupt hydro dynamic and thermal boundary layer. They not only increase heat transfer rate but also reduce the pressure loss. The ‘ v’ ribs provide 4. 5 times of higher heat transfer than continuous ribs. The square produces the best performance. The ribs height effect with refer to the triangular isolation is discussed [Sparrow, 1993]. They having two parallel walls named principle walls. In the test setup an AC power supply is used to maintain uniform heat flux. A conducting compound applied to heat principle wall to reduce the contact resistance. Lower thermal conducting plates are places to act as a thermal barrier and an exit section. It defines the heat and pressure transfer in the triangular ribs of turbulent regimes [Sparrow, 1993]. The rib turbulence causes a very high pressure drop increase, especially for high flow blockage rib. The non-uniform ribs height values provide lower heat transfer enhancement compared to corresponding uniform rib height [Sparrow, 1993]. The staggered ribs should be applied to obtain thermal performance with high and compact heat exchanger. The best operating regime for all rib tabulators is found at lower Reynolds number values. The inline rib arrangement provides higher transfer and friction loss than the staggered one for a similar mass flow rate. In comparison the larger with inline array yields the higher increase in both the Nussle number and the friction factor values but the lowest ribs with staggered array provides the best thermal performance.

Heat transfer measurements were performed on two ribbed plates with constant heat flux surface using infrared thermograph technique [Thianpong, 2009]. The test was conducted on turbulence wind tunnel at two roughness height. The transverse ribs on the plate have a square cross section shows the heat transverse not only in the ribs but also around the ribs. The pitch ratio is 12 trapped vortex flow between ribs is 5. The setup having a open tunnel of 24m with operating Reynolds number of 50 *10^4 to 150*10^4. A forced fan is driven. The constant width of 1. 14m height of different values and also it varies. The ribbed plates placed in the bottom. Six opening at the top of the roof [Thianpong, 2009]. They allow the IR camera to scan and also to determine the velocity profile around the channel. The IR camera attached to scan and it is movable. A fiberglass placed at the bottom to minimize heat loss. The flow develops hydraulically. The heat transfer is similar in all ribs [Thianpong, 2009]. At low Reynolds number the average heat transfer the high pitch plate were greater than the lower pitch plate. The higher pitch plate 1. 5 *10^6 is reversed. The pitch rate and the Reynolds number is mainly influencing in the heat transfer. Results of the present have the excellent capabilities of an infrared measurement technique for obtaining detailed distributions of heat transfer coefficient on a complex surface, capturing variation in the convection heat transfer due to the occurrence of reattachment; recirculation and separation [Thianpong, 2009]. The IR detector’s micro cooler allows the system to operate continually with precious liquid nitrogen cooled IR cameras. The camera could be pointed directly at a surface and thus one did not require mirrors which would increase errors due to transmittance effects [Thianpong, 2009]. The effect of IR camera vibration under flowing conditions in the wind tunnel were minimizing with the proper software to average sequential thermal images. The use of a zoom lens increase spatial resolution of IR camera and allowed one to obtain greater details of distributions of ribs.

Heat transfer and friction in channel with two opposite rib-roughened wails having a turbulent air flow in square duct which having two opposite rib-roughened walls [Thianpong, 2009]. They can be determining by considering the pitch-to-height and rib height-to-equivalent ratios on friction factor [Thianpong, 2009]. They also depend on the heat transfer coefficient with Reynolds number. There are four sided, two smooth duct and two ribbed duct. Stanton number in rectangular duct of four walls was developed [Wang, 2007]. A blower forced air at room temperature and pressure and a square edged plate to measure flow rate. At the end the air was exhausted [Madden, 2008]. The aluminum plates are heated parallel. The transfer rate is low in glue so it is negligible. An asbestos strip placed along the four ribbed walls to reduce the heat conducting effect [Ng, 2010]. The enclosure was filled with fiber glass. The thermocouples are used to measure air entering and leaving through the tube. Stanton number decrease with increasing Reynolds number. The P/E increase that lower friction factor and Stanton number the maximum P/E is 10. The Stanton number of ribbed side wall is about to reduce and also varies 10 percent lower than the four side ribbed duct because they influence of the smooth walls. The average friction factor can be determined by a weight average of the four-sided smooth duct friction factor, and the four sided ribbed duct friction factor is determined. The prediction method and experimental data may be applied to the design gas turbine blades internal cooling passages. Te present of the ribs on the Stanton number of the smooth side wall is also enhanced due to the present of ribs on the adjacent walls. The average friction factor of four sided smooth duct ranges high in the data and the values are lower than that of the four sided ribbed because the present of adjacent smooth walls [Yang, 1995].

Works Cited

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