Abstract

The convective heat transfer characteristics of fully-developed laminar forced flow in a rectangular channel equipped with inclined and V-shaped grooves have been investigated throughout a combination of numerical and experimental approaches. Three different shapes of grooved channels were systematically tested to measure thermal performance in the range of Reynolds numbers of 100-1000 with an applied heat flux of 15000 W/m^2 on the bottom surface of the grooved channels and using water as a working fluid. A comparison between the experimental and the numerical results was proposed and it showed a good agreement between them and the averaged deviation of skin friction coefficient and average Nusselt numbers for all grooved channels is within 8.73% and 9.13% respectively. The results show that the average Nusselt numbers and the pressure drop in all grooved channels increase with increasing Reynolds numbers according to the straight channel data. For low Reynolds numbers (less than 200), the skin friction coefficient in the grooved channels is approximately less than that of the straight channel. This indicated that the channels with the groove shapes can reduce the friction of flow at a certain level. The F-VGCH has relatively high efficiency of heat transfer rate for different groove depths because of the efficient mixing of fluid as compared with 45°-IGCH and B-VGCH and the peak value of the average Nusselt numbers is 8.98 at $Re = 1000$ and groove depth 3.5 mm. The 45°-IGCH shows a significant enhancement in heat transfer at high range of Reynolds numbers with reasonable penalty of pressure-drop. Finally, the use of F-VGCH offers the highest value of the *PEC* as compared with the other shapes of grooved channels and the peak value of *PEC* is 2.244 at $Re = 600$ and groove depth 3.5 mm.