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Comparison of rectangular winglet type vortex generators in a square duct

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Vortex generators, also called as turbulators are widely used in many industrial areas such as, automotive, aerospace, aeronautical, chemical engineering, power systems, air conditioning, refrigeration, internally cooled gas turbine blades, electronic chip cooling and other engineering applications. It is a new passive enhancement method that the heat transfer surface is altered to create secondary vortices which are carried through a heat exchanger by the core flow in order to reduce the wake regions. Those vortices enhance the heat transfer but on the other hand form pressure drop penalty relative to the smooth ducts. This research focuses on heat transfer enhancement using rectangular winglet vortex generators. For this purpose different volume flow rate for the duct entry region are specified and each of them examined in order to observe the effect of Reynolds number on heat transfer enhancement for both laminar and turbulent regions. Vortex generators are placed in the duct surface and mounted with attack angles of 15°, 30°, 45°, and 60°. Effects of each of them investigated. Pitch and blockage ratio are selected as 0.5. It was found that compared to smooth channel friction factor increases with decreasing attack angle of the vortex generators. This can be attributed to larger surface area, flow blockage and reverse flow and as expected heat transfer coefficient is significantly higher especially in 30° configuration of vortex generators. Also Nusselt number tends to increase with increasing Reynolds number. This is because vortex generators help to increase the flow turbulence degree and carry main flow to the near-wall regions where trapped flow can act effectively.

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