

Numerical Investigation of Divergence and Rib Orientation Effects on Thermal Performance in a Divergent Duct, as an Application of Inner Cooling of Turbine Blades

Authors : Heidar Jafarizadeh, Hossein Keshtkar, Ahmad Sohankar

Abstract : Heat transfer and turbulent flow structure have been studied in a divergent ribbed duct with a varying duct geometry with Reynolds numbers of 7000 to 90000 using numerical methods. In this study, we confirmed our numerical results of a ribbed duct with an Initial slope of zero to 3 degree by comparing them to experimental data we had and investigated the impact of the ducts divergence on heat transfer and flow pattern in the 2-dimensional flow. Then we investigated the effect of tilting the ribs, on heat transfer and flow behavior. We achieved this by changing the ribs angles from a range of 40 to 75 degrees in a divergent duct and simulated the flow in 3-dimensions. Our results show that with an increase in duct divergence, heat transfer increases linearly and the coefficient of friction increases exponentially. As the results show, a duct with a divergence angle of 1.5 degree presents better thermal performance in comparison with all the angle range's we studied. Besides, a ribbed duct with 40 degree rib orientation had the best thermal performance considering the simultaneous effects of pressure drop and heat transfer which were imposed on it.

Keywords : divergent ribbed duct, heat transfer, thermal performance, turbulent flow structure

Conference Title : ICHTFF 2017 : International Conference on Heat Transfer and Fluid Flow

Conference Location : Zurich, Switzerland

Conference Dates : July 27-28, 2017