World Academy of Science, Engineering and Technology
International Journal of Computer and Systems Engineering
Vol:10, No:05, 2016

Calculating of the Heat Exchange in a Rotating Pipe: Application to the Cooling of Turbine Blades

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Abstract : In this work, the results of numerical simulations of the turbulent flow with 3D heat transfer are presented for the case of two U-shaped channels and rotating rectangular section. The purpose of this investigation was to study the effect of the corrugated walls of the heated portion on the improved cooling, in particular the influence of the wavelength. The calculations were performed for a Reynolds number ranging from 10 000 to 100 000, two values of the number of rotation (Ro = 0.0 to 0.14) and a ratio of the restricted density to 0.13. In these simulations, ANSYS FLUENT code was used to solve the Reynolds equations expressing relations between different fields averaged variables over time. Model performance k-omega SST model and RSM are evaluated through a comparison of the numerical results for each model and the experimental and numerical data available. In this work, detailed average temperature predictions, the scope of the secondary flow and distributions of local Nusselt are presented. It turns out that the corrugated configuration further urges the heat exchange provided to reduce the velocity of the coolant inside the channel.

Keywords : cooling blades, corrugated walls, model k-omega SST and RSM, fluent code, rotation effect
Conference Title : ICCFD 2016 : International Conference on Computational Fluid Dynamics
Conference Location : Berlin, Germany
Conference Dates : May 19-20, 2016