Suabsakul Gururatana 2006: Study and Development of Non-Linear Turbulence Models for Complex Secondary Flows. Master of Engineering (Mechanical Engineering), Major Field: Mechanical Engineering, Department of Mechanical Engineering. Thesis Advisor: Associate Professor Varangrat Juntasaro, Ph.D.
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The cooling of turbine blades is one of the challenging problems at present. This is because the characteristics of the flow field in the internal passage of the cooling turbine blades are affected by many factors, especially the combined effects of secondary flows in the passage and the rotation of the blades. These secondary flows occur in the near wall regions and have a great effect on the characteristics of the primary flow and the cooling rate. Accurate modeling of the flow in the near wall regions is therefore necessary. This thesis aims to find the most suitable nonlinear eddy viscosity turbulence model for a rotating square duct to be used in the computational fluid dynamics (CFD) software. Firstly, we find the best Reynolds stress expression for the nonlinear eddy viscosity turbulence model using *a priori* method. Then, the currently three popular linear turbulence models that are the model with the enhanced wall function, the model with the non-equilibrium wall function and the $k-\omega$ SST model are compared to find the best linear base model using *a posteriori* method. Finally, the chosen Reynolds stress expression and the linear base model are combined as the nonlinear turbulence model. The performance of various near wall models in this nonlinear turbulence model is then analyzed. It is found that the damping function is more suitable than the enhanced and the non-equilibrium wall functions.

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