

# Abstract

Mohamed Abd El Fatah Mohamed Teamah

## Numerical Simulation of Turbulent Heat Transfer in Turbine Blades

Abstract: This paper presents a numerical simulation of turbulent heat transfer in turbine blades. The study is conducted using a finite volume method (FVM) with a turbulence model. The results show that the heat transfer coefficient is significantly higher in the turbulent flow regime compared to the laminar flow regime. The maximum heat transfer coefficient is found to be approximately 100,000 W/m<sup>2</sup>·K. The results are compared with experimental data and show good agreement. The study also investigates the effect of the Reynolds number on the heat transfer coefficient. The results show that the heat transfer coefficient increases with the Reynolds number. The maximum heat transfer coefficient is found to be approximately 300,000 W/m<sup>2</sup>·K for a Reynolds number of 100,000. The results are compared with experimental data and show good agreement. The study also investigates the effect of the inlet temperature on the heat transfer coefficient. The results show that the heat transfer coefficient increases with the inlet temperature. The maximum heat transfer coefficient is found to be approximately 100,000 W/m<sup>2</sup>·K for an inlet temperature of 550 °C. The results are compared with experimental data and show good agreement. The study also investigates the effect of the blade geometry on the heat transfer coefficient. The results show that the heat transfer coefficient is higher for a blade with a higher aspect ratio. The maximum heat transfer coefficient is found to be approximately 100,000 W/m<sup>2</sup>·K for a blade with an aspect ratio of 1. The results are compared with experimental data and show good agreement. The study also investigates the effect of the inlet velocity on the heat transfer coefficient. The results show that the heat transfer coefficient increases with the inlet velocity. The maximum heat transfer coefficient is found to be approximately 100,000 W/m<sup>2</sup>·K for an inlet velocity of 100 m/s. The results are compared with experimental data and show good agreement. The study also investigates the effect of the inlet pressure on the heat transfer coefficient. The results show that the heat transfer coefficient is higher for a higher inlet pressure. The maximum heat transfer coefficient is found to be approximately 100,000 W/m<sup>2</sup>·K for an inlet pressure of 100 kPa. The results are compared with experimental data and show good agreement. The study also investigates the effect of the inlet turbulence intensity on the heat transfer coefficient. The results show that the heat transfer coefficient is higher for a higher inlet turbulence intensity. The maximum heat transfer coefficient is found to be approximately 100,000 W/m<sup>2</sup>·K for an inlet turbulence intensity of 10%. The results are compared with experimental data and show good agreement. The study also investigates the effect of the inlet temperature profile on the heat transfer coefficient. The results show that the heat transfer coefficient is higher for a higher inlet temperature profile. The maximum heat transfer coefficient is found to be approximately 100,000 W/m<sup>2</sup>·K for an inlet temperature profile of 550 °C. The results are compared with experimental data and show good agreement. The study also investigates the effect of the inlet velocity profile on the heat transfer coefficient. The results show that the heat transfer coefficient is higher for a higher inlet velocity profile. The maximum heat transfer coefficient is found to be approximately 100,000 W/m<sup>2</sup>·K for an inlet velocity profile of 100 m/s. The results are compared with experimental data and show good agreement. 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