Dissertation Title	Computational Study for Enhancement on Cooling Effectiveness in a Turbine Blade
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ABSTRACT

The numerical simulation is still put into the design process of an advanced gas turbine blade. The blades' first stage of the turbine has to be cooled for a safe operation. In this research work, the focus of the investigation is to enhance the cooling effectiveness. Three-dimensional steady compressible Reynolds Averaged Navier-Stokes (RANS) combined with the standard $k-\varepsilon$ model and the heat equation were solved numerically by COMSOL Multiphysics 5.2 based on the finite element method (FEM). The cooling methods used for the investigation comprised a combination of impingent cooling, rib-turbulated cooling, tip-cap cooling, and trailing-edge cooling. The effects of rib turbulators, numbers and sizes of tip-cap holes, various rib configurations, and trailing-edge designs on the heat transfer were investigated by 11 types of combination. The numerical results showed that the better heat transfer performance were obtained by a combination of rib turbulators, 9 tip-cap holes with a size of 3 mm in diameter, continuous parallel 45^{o} angle rib turbulators, and two trailing-edge channels. The critical area where the maximum temperature occurs observed at the trailing-edge region was reduced significantly.

Keywords: Turbulent Flow and Heat Transfer, RANS, FEM, Rib Turbulators, Trailing-Edge Cooling, Cooling Effectiveness