

Abstract Submitted
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Large Eddy Simulation of a Film Cooling Technique with a Plenum SURANGA DHARMARATHNE, NARENDRAN SRIDHAR, GUILLERMO ARAYA, LUCIANO CASTILLO, SIVAPATHASUND PARAMESWARAN, Department of Mechanical Engineering, Texas Tech University — Factors that affect the film cooling performance have been categorized into three main groups: (i) coolant & mainstream conditions, (ii) hole geometry & configuration, and (iii) airfoil geometry Bogard et al.(2006). The present study focuses on the second group of factors, namely, the modeling of coolant hole and the plenum. It is required to simulate correct physics of the problem to achieve more realistic numerical results. In this regard, modeling of cooling jet hole and the plenum chamber is highly important Iourokina et al.(2006). Substitution of artificial boundary conditions instead of correct plenum design would yield unrealistic results Iourokina et al.(2006). This study attempts to model film cooling technique with a plenum using a Large Eddy Simulation. Incompressible coolant jet ejects to the surface of the plate at an angle of 30° where it meets compressible turbulent boundary layer which simulates the turbine inflow conditions. Dynamic multi-scale approach Araya (2011) is introduced to prescribe turbulent inflow conditions. Simulations are carried out for two different blowing ratios and film cooling effectiveness is calculated for both cases. Results obtained from LES will be compared with experimental results.

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