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# Numerical assessment of the blowing ratio on film cooling

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## Abstract

M High inlet temperatures affects efficiency of gas turbines favorably. Turbine blade cooling techniques increases the ability of the blades to withstand higher inflow temperatures. Film cooling is one of the main and best practices used in gas turbine blades cooling. The factors affecting film cooling efficiency have been categorized in to three main groups; coolant & mainstream conditions, hole geometry & configuration, and airfoil geometry (Bogard & Thole 2006). The present study focuses on effects of first and second group of factors.

Modeling of cooling jet hole and the plenum chamber is highly important in simulating accurate physics of film-cooling. Substitution of artificial boundary conditions yields unrealistic results (Iourokina and Lele 2006). Computational domains of size 84d × 3d× 8d and 6d×3d×6d are used to simulate cross flow and plenum, respectively. A cooling hole of diameter (d) = 7mm, length/diameter ratio= 2.8, injection angle= 30° and compound angle = 0° is used. Simulations are carried out for high cross flow velocity inlets with different blowing ratios( $= \rho_c U_c / \rho_\infty U_\infty$) of 0.2, 0.6, 0.85, and 1.0 to investigate variations of film-cooling adiabatic effectiveness. A reverse flow zone observed inside the cooling hole has a high impact on exit velocity profile of the jet.

No-slip condition is imposed on the walls of the plenum, coolant hole, and flat plate. Reynolds Average Navier-Stokes (RANS) modeling is implemented with standard k-ε for closure.

experimental realization of well-separated and smallest metallic nanorods via PVD, both impossible without the scientific understanding as guidance. Finally, this presentation shows potential technological applications of the science-based nanofabrication, particularly in energy and military sectors.

## Biograph

H Suranga Dharmarathne is currently a PhD candidate in Department of Mechanical Engineering, Texas Tech University, Lubbock TX. He received his Bachelors degree in Mechanical Engineering at University of Peradeniya, Sri Lanka with a First class honors in 2005 where he worked a as Lecturer in Mechanical Engineering.