Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Direct Numerical Simulation of a Film Cooling Configuration with a Micro-ramp Vortex Generator[1] AARON SHINN, S. PRATAP VANKA, University of Illinois at Urbana-Champaign — A Direct Numerical Simulation (DNS) of an inclined turbulent jet interacting with a cross-flow in a film cooling configuration is performed. The inclined turbulent jet represents the coolant flow and the cross-flow represents the hot combustion gases. In this configuration, it is known that the coolant jet tends to lift off the wall that is to be cooled, thus decreasing heat transfer effectiveness. The micro-ramp vortex generator is placed downstream of the coolant jet and is used to modify the trajectory of the coolant jet such that it remains closer to the wall, thus enhancing heat transfer. The purpose of this study is to examine the micro-ramp's effect on both the flowfield and heat transfer of the film cooling problem. The coolant jet is inclined at an angle of 35 degrees to the freestream, the blowing ratio is 1.5, and the Reynolds number based on the jet diameter and freestream cross-flow velocity is 8000. The incompressible Navier-Stokes equations are solved numerically using a 3D finite volume solver (CU-FLOW) implemented on a Graphics Processing Unit (GPU).

[1]This work was supported by a NASA GSRP Fellowship under grant number NNX08AY63H.

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Date submitted: 03 Aug 2010 Electronic form version 1.4