This thesis is an experimental and numerical full-coverage film cooling study. The objective of this work is the quantification of local heat transfer augmentation and adiabatic film cooling effectiveness for five full-coverage film cooling geometries. Experimental data was acquired with a scientific grade CCD camera, where images are taken over the heat transfer surface, which is painted with a temperature sensitive paint. The CFD component of this study served to evaluate how well the $v^2f$ turbulence model predicted film cooling effectiveness throughout the array, as compared with experimental data. Levels of laterally averaged effectiveness approach values of approximately $\tilde{\eta}=0.2$. In the presence of a favorable pressure gradient (FPG), the effectiveness values are not significantly affected on the average. Locally, however; the FPG cases result in a more level profile in the streamwise direction due the blowing ratio varying locally throughout the array. In both cases, the compound angle shift causes a decrease in film cooling effectiveness. The levels of heat transfer augmentation maintain level values of $h/h_0=1.2$. There is no effect of compound angle shift on heat transfer augmentation observed. The presence of a favorable pressure gradient does not impact heat transfer augmentation.

Major: Mechanical Engineering

Educational Career:
Bachelor's of Mechanical Engineering, BS, 2012, University of Central Florida

Committee in Charge:
Jayanta Kapa, Chair, Mechanical and Aerospace Engineering
Ali Gordon, Mechanical and Aerospace Engineering
Subith Vasu, Mechanical and Aerospace Engineering

Approved for distribution by Jayanta Kapa, Committee Chair, on March 19, 2015.

The public is welcome to attend.