Time & Location: June 10, 2019 at 2:00 PM in ENG1 288
Title: Investigation of the flow field and associated heat transfer within an asymmetrical leading edge jet impingement array

This thesis investigates the turbulent flow features present in asymmetrical leading edge jet impingement and their effects from a fluid and heat transfer prospective using both numerical and experimental techniques. The mid-jet plane flow field was quantified experimentally through the non-intrusive experimental method of Particle Image Velocimetry (PIV), while an area average heat transfer was acquired via a traditional copper block method. The numerical element served to investigate how well the Reynolds Averaged Navier-Stokes (RANS) k-ω turbulence model predicts the flow field and heat transfer within the leading edge and further investigate the results outside of the experimental scope.

Two different geometries, varied by z/d, were investigated at various Reynolds numbers ranging from 20,000 to 80,000. The geometry consisted of an array of 9 identical jets impinging on a leading edge of diameter D/djet = 2, with an asymmetrical sidewall configuration to simulate that closer of a real leading edge. Several vortices were present at the upstream jets in the leading edge geometry. These vortices were larger for in the z/d = 4 configuration but did not contribute to any increased or decreased heat transfer compared to that of the z/d = 2.7 configuration. The most influential aspect to both the flow field and heat transfer was the change in bulk velocity between the two geometries. The smaller cross sectional area of the z/d = 2.7 configuration saw in increase in bulk velocity and jet bending, tending to also decrease the heat transfer. The numerical results also reflected these results and in both area averaged heat transfer and localized heat transfer contour plots.

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Approved for distribution by Jayanta Kapat, Committee Chair, on May 8, 2019.

The public is welcome to attend.