SUBJECT: Ph.D. Proposal Presentation

BY: Donavon Gerty

TIME: Monday, December 19, 2005, 9:00 a.m.

LOCATION: Love Building (MRDC II), Room 210

TITLE: Fluidic-Driven, Ducted Heat Ejector

COMMITTEE: Dr. Ari Glezer, Chair (ME)
Dr. Marc Smith (ME)
Dr. Yogendra Joshi (ME)
Dr. Donald Webster (CEE)
Dr. Raghav Mahalingam (Innovative Fluidics)

SUMMARY

Unsteady, small-scale fluid mechanics and heat transport processes within a high-aspect ratio ducted heat ejector are investigated experimentally. The ducted heat ejector exploits flow that is induced within a channel by the motion of a vibrating reed to cool the inner surfaces of the duct walls and thereby transport heat across its boundaries to cool electronic hardware by direct contact. The flow is induced by the motion of a cantilevered vibrating reed driven by a piezoelectric unimorph actuator that is mounted between the duct walls. The time harmonic motion of the reed results in the regular shedding of vortical structures and induces a net flow through the duct. The proposed work focuses on the flow characteristics and the heat transfer performance. Particle image velocimetry (PIV) is used to measure the flow field associated with the motions of the induced vortex train and to educe spatial distributions of the velocity, vorticity, and turbulence (including dissipation and production). The effects of the actuator motion on the induced flow are also investigated. Of particular interest is the effect of small-scale motions and enhanced mixing on heat transfer across the duct boundaries and its comparison to conventional time-invariant channel flows at similar or higher Reynolds number. The proposed research will build on preliminary work that has demonstrated the performance of the ducted heat ejector and, based on investigation of the fundamental mechanisms will extend the parametric characterization of the heat transfer.