Announcing the Final Examination of Michael Elmore for the degree of Master of Science

Time & Location: October 25, 2018 at 9:00 AM in ENGR 288
Title: Analysis of Heat Transfer on Turbulence Generating Ribs using Dynamic Mode Decomposition

Ducts with turbulence-promoting ribs are common in heat transfer applications. This study uses a recent modal extraction technique called Dynamic Mode Decomposition (DMD) to determine mode shapes of the spatially and temporally complex flowfield inside a ribbed duct. One subject missing from current literature is a method of directly linking a mode to a certain engineering quantity of interest. Presented is a generalized methodology for producing such a link utilizing the data from the DMD analysis. Theory suggests exciting the modes which are identified may cause the flow to change in such a way to promote the quantity of interest, in this case, heat transfer. This theory is tested by contouring the walls of the duct by the extracted modes shapes.

The test procedure is taken from an industrial perspective. An initial, unmodified geometry provides a baseline for comparison to later contoured models. The initial case is run as a steady-state Reynolds-Averaged Navier-Stokes model. Large-Eddy Simulation generates the necessary data for the DMD analysis. Several modes shapes extracted from the flow are applied to the duct walls and run again in the RANS model, then compared to the baseline, and their relative performance examined.

Major: Aerospace Engineering

Educational Career:
Bachelor’s of Aerospace Engineering, BS, 2018, University of Michigan

Committee in Charge:
Jayanta Kapat, Chair, CECS
Kareem Ahmed, Mechanical and Aerospace Engineering
Samik Bhattacharya, Mechanical and Aerospace Engineering

Approved for distribution by Jayanta Kapat, Committee Chair, on October 10, 2018.

The public is welcome to attend.