AE 3051 Experimental Aerodynamics (1-3-2)

Catalog Description: AE 3051 Experimental Fluid Dynamics. Experiments in fluid mechanics, aerodynamics and propulsion with emphasis on data acquisition and analysis, e.g., measurement techniques, laboratory instrumentation, errors and noise in measurements, and digital sampling.

Text: Web site http://www.ae.gatech.edu/classes/ae3051/

Course Coordinator: Prof. J. Seitzman

Learning Objectives:

1. Provide students with a "hands-on" experience of concepts taught in the aerodynamics, fluids and propulsion courses;
2. Teach experiment design, data analysis and measurement methods/techniques employed for aerodynamic and fluid systems;
3. Help develop effective communication skills, in both written and oral form.

Expected Outcomes: Students will have gained: a) hands-on experience with flow over airfoils/wings, boundary layers, wake and jet free shear flows, and reacting and supersonic flows; b) understanding of the basic operation of common flow facilities, such as subsonic and supersonic windtunnels, shock tubes, combustors and jet engines; c) ability to develop a preliminary design of an experiment to test a hypothesis or perform a required measurement; d) familiarity with the use of various measurement devices/transducers, including: force balances, Pitot probes, capacitance-, piezoelectric-, and piezoresistive-based pressure transducers, hot-wire and Laser Doppler anemometers, thermocouples, photomultipliers, and flow visualization techniques (including schlieren imaging and tracer methods); e) experience performing steady and time-dependent data analysis of experimental measurements, including estimation of errors/uncertainty; and f) practice in writing technical reports and making technical presentations that employ effective communication and graphical presentation skills.

Prerequisites: AE 2020, AE 3450 (corequisite)

Topics:
Lab 1 - Force Measurement in a Subsonic Wind Tunnel
Lab 2 - Pressure Measurement and Flow Visualization in Subsonic Wind Tunnels
Lab 3 - Digital Sampling of Time-Dependent Signals (and Frequency Analysis)
Lab 4 - Unsteady Velocity Measurements in a Jet Using a Hot-Wire Anemometer
Lab 5 - Unsteady Velocity Measurements in a Jet Using a LDV
Lab 6 – Temperature and Pressure Measurements in a Turbine Engine
Lab 7 - Measurements in Unsteady Combustion
Lab 8 - Transient Measurements in a Shock Tube
Lab 9 - Optical/Pressure Measurement in Supersonic Flows
Lab 10 – Experimental Planning

**Communication:** For each lab, students must prepare a technical report. The lab reports are graded, with the grade emphasizing not only the content, but also the effectiveness of the communication. There is also an oral presentation at the end of the semester, preceded by a lecture that describes skills for preparing and delivering effective technical presentations.