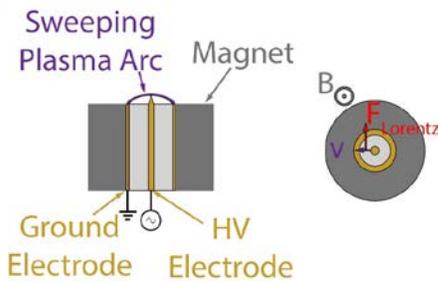


Project Title: Cyclotronic Plasma Actuator Experimental Studies

Adviser: Joseph W. Zimmerman, Ph. D., Senior Scientist, CU Aerospace LLC

Project Description:

CU Aerospace (CUA), in research partnership with the University of Illinois (UIUC) AE department, has developed a new class of plasma flow-control actuator technology referred to as the Cyclotronic Plasma Actuator. In this new concept, an atmospheric-pressure plasma arc is generated in the gap between a pair of coaxial cylindrical electrodes. Introduction of a magnetic field normal to the arc breakdown path produces a Lorentz force on the charged particles causing the arc to rotate rapidly about the central axis of the electrodes, resulting in an apparent plasma “disc” to the observer. When placed in a flow field (e.g., embedded in an airfoil surface) this device interacts with the boundary flow through both body force effects and heating from plasma power deposition in the arc. The intended application of this concept is as an “on-demand” vortex generator, which provides similar performance of conventional vane-type vortex generators during takeoff and landing segments, while eliminating the drag penalties associated with conventional devices during high-speed cruise segments. CUA and UIUC are currently partnered in a 24-month NASA-funded research effort to promote the technology readiness level (TRL) of this new flow-control actuator concept. CUA seeks assistance from an undergraduate researcher which will supplement the current research activities.



Representative schematic of actuator operation (side and top views).

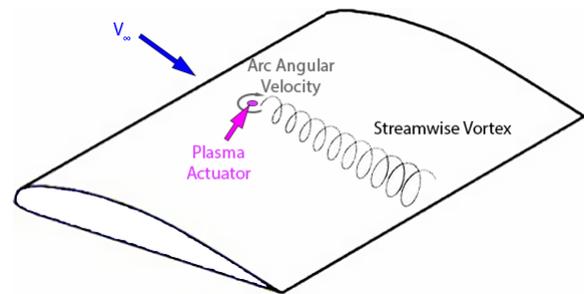
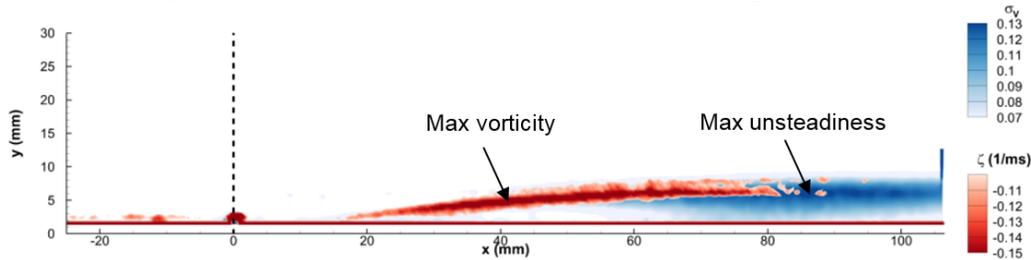


Illustration of low-complexity, on-demand cyclotronic plasma actuator on an airfoil.



Co-plot of z-vorticity and velocity standard deviation contours, with locations in maximum magnitudes indicated by arrow symbol; actuator at $x = 0$.

Student Background and Expected Research Activities:

Responsibilities will be multifaceted, focusing on experimental studies and design work for actuator bench-test prototypes. Anticipated duties for the undergraduate researcher are: construction of experimental apparatus, participation in plasma actuator tests, experimental data reduction, circuit design analyses, CAD, evaluation of materials selection, and basic reporting. Desired skills of the applicant are mechanical aptitude, basic computer skills and programming knowledge (e.g., spreadsheets, plotting software, MATLAB script, C/C++), experience with electrical circuits (basic assembly or simulation), and CAD experience.

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