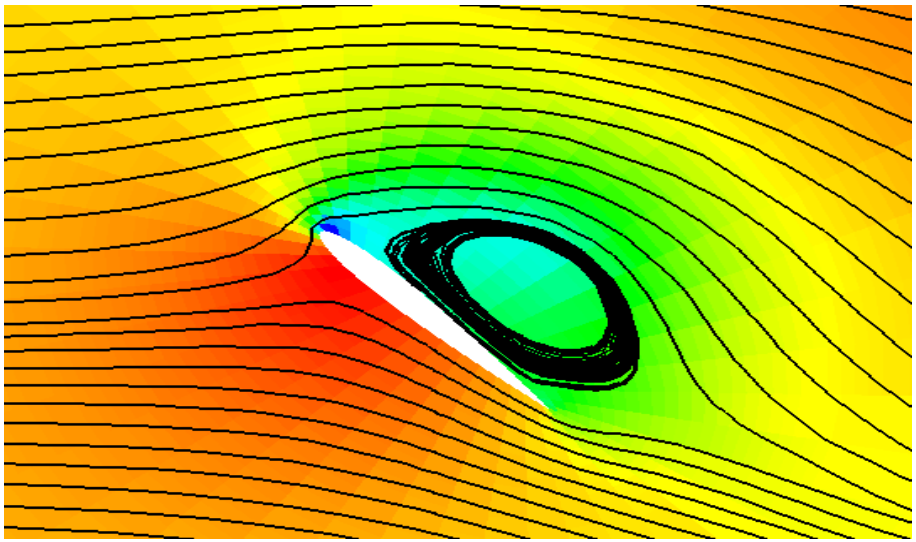
NASA SBIR/STTR Technologies

A2.05-9240 - Shock Wave Boundary Layer Interaction Control Using Pulsed DBD Plasma Actuators

PI: Alexandre Likhanskii
Tech-X Corporation - Boulder, CO

Identification and Significance of Innovation

We propose to develop full plasma/CFD experimentally validated modeling capability for DBD plasma actuators for the problem of Shock Wave Boundary Layer Interaction (SWBLI) control. During Phase I of the project, we will develop a prototype simulation tool for SWBLI control system using DBD plasma actuators, demonstrate the feasibility of the proposed control approach both using numerical simulation and wind tunnel experiments at Princeton University and validate developed prototype against experimental and available numerical data. we propose to extend our simulation capabilities to full plasma/CFD modeling of DBD plasma actuators for the problem of Shock Wave Boundary Layer Interaction (SWBLI) control. After the completion of the Phase II of this project, NASA scientists will get a validated high-fidelity state-of-the-art simulation tool for the SWBLI control system as well as a set of experimental data to facilitate the advances in NASA missions.



Estimated TRL at beginning and end of contract: (Begin: 2 End: 4)

Technical Objectives and Work Plan

Technical Objectives:
- Demonstrate Nautilus's capability of modeling SWBLI.
- Demonstrate feasibility of the pulsed DBD plasma actuator control of SWBLI.
- Validate developed prototype of SWBLI simulation tool against experimental data and available numerical data.

Work Plan:
- Develop prototype SWBLI simulation tool.
- Develop prototype simulation tool for SWBLI control using pulsed DBDs.
- Perform experimental demonstration of SWBLI control using pulsed DBDs
- Validate developed prototypes by comparing simulation and experimental results
- Reporting

NASA Applications

- Active flow control for inlet of scramjet engine;
- Active flow control at the leading edge of hypersonic vehicle
- Active flow control for aircraft wings and turbine blades
- Integration with high-fidelity NASA codes for solution of multiphysics problems

Non-NASA Applications

- Active flow control for hypersonic vehicles, such as DARPA FALCON project and Boeing X-51
- Active flow control for commercial airplanes during take-off and landing
- Active flow control for UAVs
- Improvement of efficiency of windmills by suppressing flow separation at high angles of attack

Firm Contacts

Alexandre Likhanskii
Tech-X Corporation
5621 Arapahoe Avenue, Suite A
Boulder, 803031379
PHONE: (303) 448-0727
FAX: (303) 448-7756