FLOW CONTROL USING DBD PLASMA ACTUATORS: EXPERIMENTAL INVESTIGATION

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The use of actuating systems based on Dielectric Barrier Discharge plasma has proved for more than one decade their potentialities to manipulate flow for a wide range of applications.

For this project, it is already known that a DBD actuator has a real effect on the external flow, but the interaction mechanisms between the plasma and the external flow are not well-known. The aim of this work is thus to understand better this interaction in order to become able to control/reduce the instabilities arising from flow separation. Furthermore, this project constitutes a part of the project DINNO CROR for noise reduction applications.

Preliminary studies have been performed to provide a physical insight of the key operating settings ruling the actuator efficiency. Indeed, to understand influence of passive parameters (geometrical parameters) and active parameters (feeding conditions), different actuators were manufactured and tested for a wide range of operating conditions. Comprehensive measurements of thrust against the dissipated power were performed.

Starting from the recommendations obtained in this preventive part, DBD actuators have been judiciously designed and installed on a cylinder and an airfoil to investigate their potentialities to reduce the flow separation. The effect on the flow has been explored by means of smoke visualizations and hot wire measurements.

The principal result of this investigation is that the DBD actuation can be used to control or reduce the instabilities arising from flow separation but this is limited to low Reynolds number.

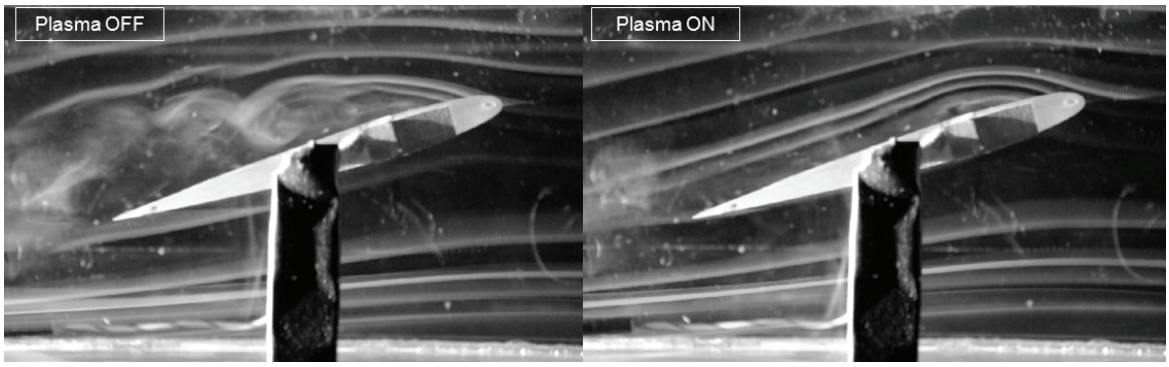

Figure 1: Smoke visualizations of the airflow streamlines along a 16° inclined NACA 0010 airfoil at Re=15200