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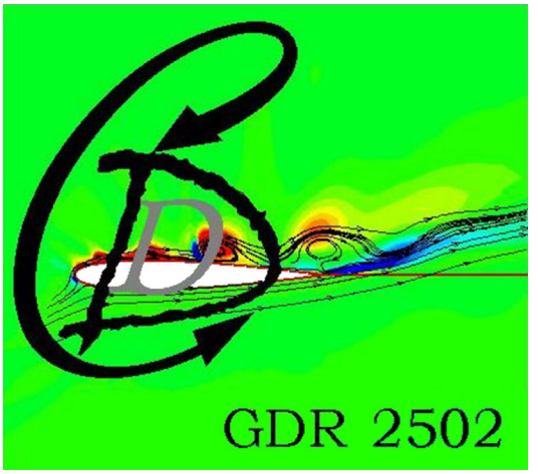
Separation flow control

Foreword



The conception of aeronautic systems or road vehicles faces challenging issues such as the prediction of receptivity modes generated by actuation, the development of an optimal and robust control, closed loop, the conception of micro-scale actuators and sensors, the optimal use of energy conversion, the establishment of a measurement fast estimation process … To address these issues, a better understanding of the underlying physics and of the related interactions is needed.

In the context of aerodynamic performance, which is the cornerstone in both aeronautic and automotive domains, flow separation presents an important issue challenge. This mechanism leads to a decrease in performances. One way to improve things in such situations is to use a control. This control must be an active and low-cost one.

The efficiency of the control is closely dependent on the used systems and techniques. To reach this goal, scientific and technical progresses are needed. From the scientific point of view, the mechanisms leading to separation have to be analyzed and characterized. Also, the actuation has to be efficient, with low cost. The technical goal concerns both the sensor and actuator systems. More exactly, the question is to know which parameter has to be selected to first apply the actuation and then to evaluate the results by using suitable sensors. For the actuation, it relies on the choice of the high-quality actuator to develop so as to be able to fully satisfy the requirements.

Our GDR (*Groupement de recherche*/Joint Research Project) is a CNRS federative project between French academic research laboratories and ONERA departments working in the framework of flow control and sensors or actuators technologies. Aeronautical and car industries interested in using flow control are also involved as partners (Dassault Aviation, PSA, Renault, SNECMA, Plastic-Omnium, Eurocopter). This GDR is a multi-disciplinary network. The objective of this national network is to develop a collaborative project from the fundamental concept to a full-scale demonstrator.

The works presented in this thematic issue of the *Comptes rendus Mecanique* cover experimental, numerical and theoretical studies carried out in the context of a French national program (GDR2502 “Flow Separation Control”) devoted to the

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design of better actuators and aiming at setting up an optimal and robust control. The development of sensors and actuators is also included. Both open and closed loops have been satisfactorily tested. A reduced-order model is used to better analyze the effect of the control and to perform its optimization.

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