PhD Proposal 2017

School: Ecole Centrale Marseille	
Laboratory: M2P2	**Web site: www.m2p2.fr**
Team: ITC	**Head of the team: E. Serre, J. Favier**
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Collaboration with other partner during this PhD: **In France:**	**In China:**

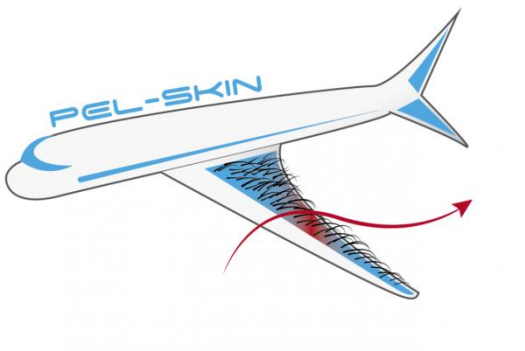
Title: Flow control using a poroelastic coating inspired by birds feathers.
Scientific field: Mechanical engineering
Key words: CFD, flow control, biomimetics

Details for the subject:

Background, Context:

Reducing, or supressing the boundary layer separation around an immersed body can lead to great benefits in terms of aerodynamical performances (increase lift, decrease drag, delay stall on wings. This phd daims at studying numerically the use of porous deformable media, inspired by the popping of feathers observed during birds' landing, to control the boundary layer separation on the wings. These passive devices are thought to be stuck on an aircraft wing, and interact postively with the surrounding flow.

A recent Lattice Boltzmann code has been developed (during a phd which ends in November 2016), to tackle porous unsteady geometries immersed in fluid flows. The aim is to design new control strategies using such kind of actuators, which are originally inspired by birds feathers (porous, elastic and non-isotropic media). The potential of this new concept of flow control actuator has been previously demonstrated in a European FP7 project PELskin involving 5 Universities (coordinated by J. Favier).



Research subject, work plan:

Two parts can be expected for the phd :

1. Use the lattice boltzmann solver to design novel control strategies on idealized configurations of separated laminar flows ,
2. Implement these control techniques in a larger scale code to scale up the problem to turbulent configurations.

In particular, the physical mechanisms will be identified first for laminar flows, and higher Reynolds number configurations will be subsequently considered to assess if these mechanisms still hold for turbulent flows.

References on this topic:

Favier J, Dauptain A, Basso D, Bottaro A (2009) Passive separation control using a self-adaptive hairy coating. Journal of Fluid Mechanics 627:451–483

A coupled Immersed Boundary - Lattice Boltzmann method for incompressible flows through porous media. Pepona M. & Favier J.
Journal of Computational Physics, Vol. 321, pp. 1170–1184, 2016.

PELskin project - part I - Fluid-structure interaction in a row of flexible flaps: a reference study in oscillating channel flow. Favier, J., Li, C., Kamps, L., Revell, A., O'Connor, J., & Brucker, C. Meccanica, in press, 2016.

PELskin project - part II - Investigating the physical coupling between flexible filaments in an oscillating flow. Revell, A., O'Connor, J., Sarkar, A., Li C., Favier J., Kamps, L., & Br\"ucker, C. Meccanica, in press, 2016.