Feedback control design on wind turbine blade to alleviate aerodynamic loads
12 Month Post-doctoral position, starting (from) March 2016

Salary: 2500 euros/month (without taxes)

Location:
LHEEA laboratory
Ecole Centrale Nantes
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Context:
The turbulent atmospheric boundary layer in which wind turbines are implemented is strongly inhomogeneous and unsteady. This induces unsteady mechanical loads at different characteristic time scales from seconds to minutes. The variability of the wind conditions generates rough operating conditions for wind turbines which limits significantly their life time. Different control strategies have been proposed in the framework of ANR SmartEole (ANR-14-CE05-0035) to alleviate the impact of these upstream fluctuations at the farm, wind turbine and blade scales. The present work, which is part of this ANR project, focus on feedback control strategies at the blade scale, to alleviate fatigue loads.

Work:
A wind turbine blade profile has been designed/manufactured to integrate pulsed jet actuators. First tests have shown that a line of transverse jets located at the trailing edge is able to manipulate the lift curve. These results will be presented at the Torque conference in Oct. 2016 [1]. What remains now is to perform feedback control strategies. A first approach can be to perform open-loop identification of the dynamics and an OFF-LINE control designed, similarly as performed by Shaqarin et al [2]. For the experimental implementation of the feedback control, the researcher will work in close relation with C. Braud (CNRS Researcher at LHEEA laboratory). The control design will be developed together with D. Peaucelle (CNRS Researcher at LAAS Laboratory, Toulouse, France). Final experiments will take place at the PRISME laboratory (Orléans, France). There is also the possibility to test different control strategies numerically from a collaboration with E. Guilmineau (CNRS Researcher at LHEEA laboratory).

References:
[1] C. Braud. “Flow circulation control at the blade scale to alleviate fatigue loads of the wind turbine.” To be submitted in The Science of Making Torque from Wind, München, Germany, October 5-7 2016
[2] T. Shaqarin, C. Braud, S. Coudert, and M. Stanislas. “Open and closed-loop experiments to identify the separated flow dynamics of a thick TBL.” EIF, 54(1448), 2013.

Ideal Candidate:
PhD in Fluid Mechanics
Experience in conducting experiments (ideally flow control experiments)
Knowledge of Matlab/Simulink will be appreciated
Experience in using numerical codes (ideally implementation of control)

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