

## RESEARCH TOPIC FOR THE PARISTECH/CSC PHD PROGRAM

**Field: Energy, Processes**

**Subfield:** Fluid mechanics, Aeroacoustics, Turbomachinery

**Title:** Study of the aeroacoustic behavior of counter rotating subsonic axial flow fans

**ParisTech School:** Arts et Métiers Sciences et Technologies

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**Research group/Lab:** LIFSE

**Lab location:** Paris

**Lab website:** <https://lifse.artsetmetiers.fr>

### **Short description of possible research topics for a PhD:**

Noise pollution has become an important environmental concern. Increasing comfort requirements and tightening the world regulations have transformed the reduction of the aerodynamic noise of turbomachines into a crucial issue for many industries. Various sectors are concerned: cooling automotive and electronic circuits, air conditioning in air transport or terrestrial as well as in the building, ventilation of industrial installations, air conditioning or refrigeration. The sound discrimination of a turbomachine is now a criterion of selection and quality. Moreover, the specifications submitted to the manufacturers fans include increasingly severe limitations of the maximum noise level. These noise limitations are often accompanied by a demand for increased power aerodynamic and compactness reduction. It is therefore necessary to predict the noise generated by a fan and particularly the master of the unsteady flow surrounding airfoils.

The aims of this PhD is to study how the counter rotating fans can help to answer to this issue. At present, the design method of counter-rotating axial flow fan taking into account the aeroacoustic behavior are insufficient and the experimental results and data are few. There are also problems such as low efficiency, structural vibration, blade stall, specific to this technology. The reason is that the design of counter-rotating axial flow need to be further investigated. The fundamental way to improve the aeroacoustic performances of counter-rotating axial-flow fan is therefore to identify the main geometrical and physical control parameters related to the noise generation mechanisms.

### **Required background of the student:**

Fluid mechanics, Mechanical Engineering

### **A list of representative publications of the group:**

1. S. Khelladi, S. Kouidri, F. Bakir, R. Rey, Predicting Tonal Noise from a High Speed Vaned Centrifugal Fan, Journal of Sound and Vibration, 2008
2. J. Hurault, S. Kouidri, F. Bakir, R. Rey, Experimental investigations on the wall pressure measurement on the blade of axial flow fans, Flow Measurement and Instrumentation, 2010
3. H. Nouri, F. Ravelet, F. Bakir, C. Sarraf, R. Rey, Design and experimental validation of a ducted counter-rotating axial-flow fans system. Journal of Fluids Engineering, 2012
4. H. Nouri, A. Danlos, F. Ravelet, F. Bakir, C. Sarraf, Experimental study of the instationary flow between two ducted counter-rotating rotors. Engineering for Gas Turbines and Power, 2012.