

LABORATOIRE DE MECANIQUE DES FLUIDES (LABORATORY OF THE MECANICS OF THE FLUIDES)

Head (*): Fawaz Massouh
Secretary (): Martine Portolan**
Author (*) : Ivan Dobrev, Fawaz Massouh**

ENSAM, 151 Bd. de l'Hopital,
75013 PARIS- FRANCE

<http://www.paris.ensam.fr>
Phone: 33 (0)1 44 24 62 56, Fax: 33 (0)1 44 24 62 66

*E-mail: Fawaz.Massouh@paris.ensam.fr ,

**E-mail: Martine.Portolan@paris.ensam.fr ,

***E-mail: Ivan.Dobrev@paris.ensam.fr,



Brief presentation

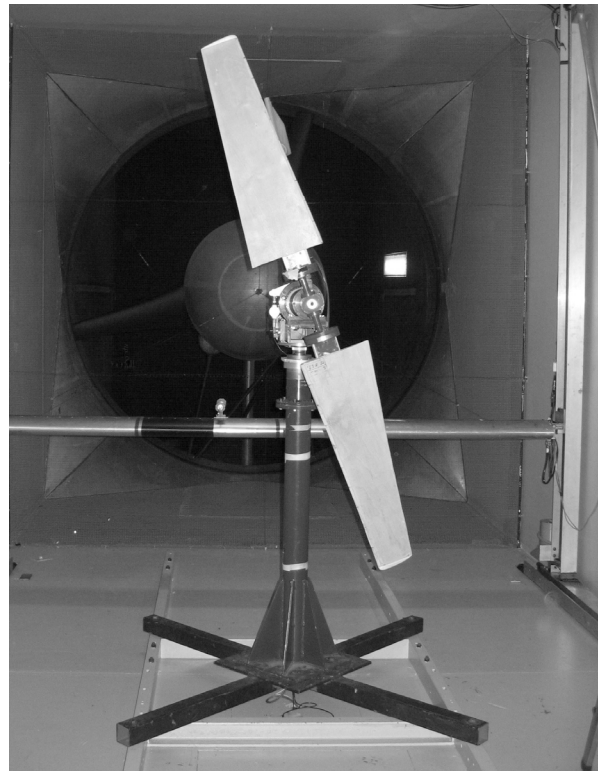
ENSAM was founded in 1780 by the duke of La Rochefoucauld-Liancourt, and so far has trained more than 78,000 engineers who have taken part in the industrial development of France. ENSAM is a state institution of scientific, cultural and professional nature placed under the authority of the French Ministry in charge of higher education. ENSAM is composed of 11 Regional Centers and Institutes all over France. As an institution dedicated to teaching technology at the highest levels, ENSAM is involved with theoretical and practical research, and is closely tied to the industrial world. ENSAM now has 22 research groups, either associated or co-associated with the French national organization for scientific research (CNRS), or recognized by the French Ministry of Education or operating under the auspices of ENSAM. The major fields of study research are:

- Mechanics, materials, manufacturing processes.
- Fluid mechanics, energy systems.
- Design, industrialization, risk, decision making.

The Fluid mechanics laboratory at ENSAM-Paris has a wind tunnel equipped with a high precision system for aerodynamic force measurements. The velocity field can be measured by means of particles image velocimetry (PIV) and 3D hot-wire anemometry (HWA). Many research projects are carried out in the fields of automotive and wind turbine aerodynamics.

For several years various investigations on wind turbine wake have been carried out using PIV and HWA. The

obtained experimental data makes it possible to validate the wind turbine rotor models developed by the laboratory team.



Wind turbine measurement bench

Collaborations, national and international, present and calls for collaborations

Collaboration with: French agency of environment and energy ADEME, ONERA, NREL, Technical University

of Denmark DTU, University of Trondheim NTNU, Technical University of Sofia, Moscow Institute of Energy MPEI, ETSMTL-Montreal, etc.

Acknowledgements

Special thanks are addressed to the French Energy Agency ADEME for their support and funding

References

1. Massouh F., Dobrev I. Exploration of the vortex wake behind of wind turbine rotor // Journal of Physics (IOP) Vol. 75 (2007) 012036, <http://www.iop.org/EJ/abstract/1742-6596/75/1/012036>
2. Dobrev I., Massouh F., Rapin M. Actuator surface hybrid model // Journal of Physics (IOP) Vol.75 (2007) 012019, <http://www.iop.org/EJ/abstract/1742-6596/75/1/012019>
3. Dobrev I., Massouh F. Etude du couplage aéroélastique dans le cas d'un rotor éolien, CFM2007-Grenoble, 27-31 Août 2007.
4. Massouh F., Dobrev I., Rapin M. Experimental and Numerical Survey in the Wake of a Wind Turbine // AIAA paper 2007-0423, 45th AIAA Aerospace Sciences Meeting and Exhibit, Reno, NV, Jan. 8-11 2007.
5. Massouh F., Dobrev I. Investigation of Flow Downstream a Horizontal Axis Wind Turbine, 1st International Symposium on Environment, Identities and Mediterranean Area (ISEIM'2006) July 9-13, 2006 - Corte - Ajaccio (France).
6. Jourieh M., Kuszla P., Dobrev I., Massouh F. Hybrid rotor models for the numerical optimisation of wind turbine farms, 1st International Symposium on Environment, Identities and Mediterranean Area (ISEIM'2006) July 9-13, 2006, Corte - Ajaccio (France).
7. Massouh F., Dobrev I., Rapin M. Numerical simulation of wind turbine performance using a hybrid model // AIAA paper 2006-0782, 44th AIAA Aerospace Sciences Meeting and Exhibit, Reno, NV, Jan. 9-12, 2006.
8. Massouh F., Dobrev I. Investigation of wind turbine near wake, Int. Conf. on Jets, Wakes and Separated Flows, ICJWSF-2005. P.513-518. October 5-8, 2005, Toba-shi, Mie, Japan,
9. Dobrev I., Massouh F. Etude d'un modèle hybride pour représenter l'écoulement à travers un rotor éolien, 17^{ème} Congrès Français de Mécanique, 29/8-2/9/2005, Troyes.
10. Massouh F., Dobrev I., Jourieh M. Etude par PIV du sillage proche d'une éolienne, FLUVISU 11. COLLOQUE de VISUALISATION et de TRAITEMENT D'IMAGES en MECANIQUE des FLUIDES. Ecole Centrale de Lyon 6-9 Juin, 2005.
11. Massouh F., Dobrev I., Dejean F., Laborie A. Etude du sillage d'une éolienne à axe horizontal, 16^{ème} Congrès Français de Mécanique CFM 2003, Nice, 1-5 septembre 2003.

