

## **Aerodynamic and Acoustic Design Optimization of a Multiple Propeller Combination for Distributed Electrical Propulsion**

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**Key Words:** *Distributed Electrical Propulsion, High-Lift, Multiphysics Problems, Multi-Point Design, Evolutionary Computing*

This work aims at optimizing a large-scale wind tunnel model conceived to investigate the aerodynamic and acoustic performance of distributed electrical propulsion (DEP) on aircraft wings in high lift conditions. The aim of the optimization process is to obtain the best possible improvements in Noise and Aerodynamic performance by modifying the propellers' layout of the Wing-DEP wind tunnel model. A multi-objective, multi-point design approach is adopted based on evolutionary computing. The robustness of the obtained solution set is also investigated. The research work is carried out in the framework of VENUS EU-funded project GA N. 886019.

### **REFERENCES**

- [1] Casalino, D., Barbarino, M. and Visingardi, A., Simulation of Helicopter Community Noise in Complex Urban Geometry, *AIAA Journal*, Vol. 49, No. 8 (2011), pp. 1614-1624. DOI: 10.2514/1.J05077.
- [2] Visingardi, A., D'Alascio, A., Pagano, A. and Renzoni, P., Validation of CIRA's Rotorcraft Aerodynamic Modelling SYSTEM with DNW Experimental Data, *22nd European Rotorcraft Forum, Brighton, UK*, (1996).
- [3] Quagliarella, D., Aerodynamic Shape Design Using Evolutionary Computation: A Tutorial with Examples and Case Studies, in *Computational Intelligence in Aerospace Sciences*, Vasile M. and Becerra V. M. eds., pages 529–581, American Institute of Aeronautics and Astronautics (AIAA), (2014).