

Master project, 2023 – 2024

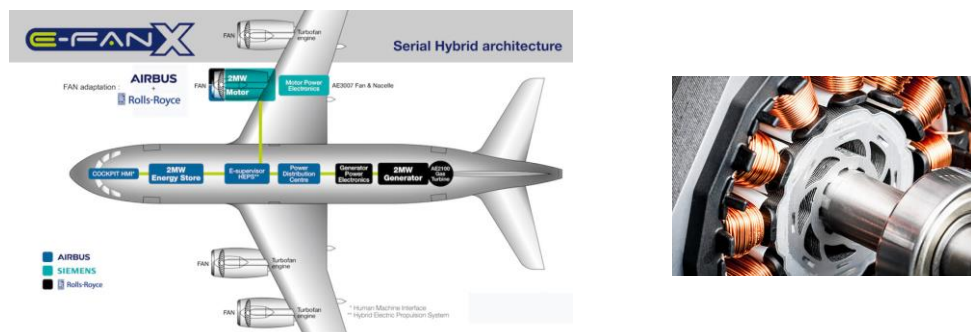
Design and study of a polyphase machine aimed at avionic transportation

Supervisors: Abdelmounaim Tounzi, NgacKy Nguyen

Contact: abdelmounaim.tounzi@univ-lille.fr, NgacKy.NGUYEN@ENSAM.EU

Context

Within the context of the growing interest in electric propulsion of aircraft, the design of electric machines meeting the requirements and constraints of such an application is of great interest. Various work is underway in this area and several prototypes have been designed and studied but no standard solution or structure has yet emerged. Work continues and research is still being carried out to find the most suitable machine. Indeed, the electric machine must be compact, with a high power/mass ratio, operating at high speed and capable of operating in degraded mode if necessary. A lot of work is still necessary to arrive at the machine which would meet all the constraints while ensuring the highest efficiency.



Objective

The objective of the proposed master work consists at prospecting one solution for the aircraft propulsion. It aims at designing and studying two structures of polyphase permanent magnet machine (surface mounted and inserted permanent magnets) in order to quantify their performance and analyze their suitability for such an application.

Work steps

- 1 Bibliographic study on the various electric machines studied or used in the avionic transportation. Analysis of the advantages and drawbacks of the different solutions. Critical synthesis of the performance of each solution
- 2 Numerical modeling and study of a three phases machine designed by MIT.
- 3 On the basis of considerations related to the aimed application, discuss the well adapted polyphase arrangement
- 4 Using the same rotor as the one of the MIT prototype, design a stator with the proposed polyphase arrangement and study its performance.

Keyword

Electric machine for avionic propulsion, Polyphase machine, design, numerical modelling

References

- [1] A. P. Dowdle, 'Design of a High Specific Power Electric Machine for Turboelectric Propulsion, PhD Thesis – MIT - 2022.
- [2] C. Gerada; M. Galea; A. Kladas, 'Electrical machines for aerospace applications,' 2015 IEEE Workshop on Electrical Machines Design, Control and Diagnosis (WEMDCD). DOI: 10.1109/WEMDCD.2015.7194513
- [3] Xiaolong Zhang, Cheryl L. Bowman, Tim C. O'Connell, Kiruba S. Haran , 'Large electric machines for aircraft electric propulsion', IET Electric Power Applications, doi.org/10.1049/iet-epa.2017.0639. 2018.