

Comparison of multi-phase electric machine designs

Project Description

A limiting factor to the range of electrically driven airplanes is the energy density of present energy storages. Therefore, enhancing the energy efficiency as well as the robustness and reliability of the electric drive systems is a key point. In

this context, multi-phase electric machines as part of a power drive system for aviation propulsion offer two key opportunities: It is possible to reach a high energy efficiency combined with the necessary fail safety.

This project aims at investigating different numbers of phases for permanent magnet synchronous machine designs regarding their energy efficiency and power density only taking into account the fundamental frequency as a first step. Therefore, machine parameters will be obtained by finite element analysis and used in analytical machine models to calculate the machine's losses. In order to enhance the results, the loss calculation should take into account the additional losses in the inverter for multi-phase machines and additional harmonic losses. For a valid comparison of different machine designs, the calculations will be performed for a reference flight mission of the SE²A reference airplane displayed adjacent.



Requirements

- Motivation to investigate electric machine options for future all electric aircrafts
- Basic knowledge of electrical machines and power electronics
- Basic programming skills in Matlab/Python
- Knowledge of any software using the finite-element method is of advantage
- English language skills; basic German language skills come in handy for private matters, but are not required for the project

Contact information

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The entry date is as soon as possible, and the duration of employment is limited to 6 months. The position is part-time with 50% of the regular weekly working time (currently 19,9h). Ongoing applications are possible until all positions are filled.

The payment is made according to task assignment and fulfillment of personal requirements to salary group EG 13 TV-L. International applicants may have to successfully complete a visa process before hiring can take place. Candidates with handicaps will be preferred if equally qualified. Please enclose a proof. The position is part of the SE²A International Female Programme, so only applications by female graduates of non-German universities are possible.

All documents should be in PDF format, preferably in a single file. Personal data and documents relating to the application process will be stored electronically. Please note that application costs cannot be refunded.

References

- [1] Karpuk, S. and Elham A.: Influence of Novel Airframe Technologies on the Feasibility of Fully-Electric Regional Aviation. *Aerospace*, **2021**, 8, 163.