

Research group *Composites in Mechanical Engineering* (THA_comp)

Concept Study of a Cryogenic Hydrogen Cooled Axial Flux Engine for Aerospace Applications

In this project, a concept study for a lightweight cryogenic hydrogen-cooled axial flux motor is developed. The concept is based on a hybrid material design to fulfill the electromagnetic, thermal, chemical, and mechanical requirements for a high-performance electrical drive train for Urban Air Mobility (UAM) applications. The concept study focuses on the virtual pre-design of the rotor-stator combination and the cooling system using composites and ferromagnetic materials. FE and electromagnetic performance simulation results based on trade studies will be performed. A Design of Experiment (DoE) will also be derived for the thermal and chemical material characterization of the cooling system operated with cryogenic hydrogen.

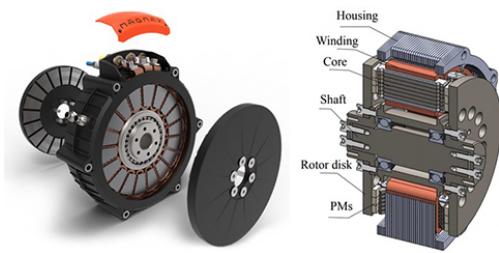


Fig. 1: Axial Flux Engine [Magnax Motoren]



Fig. 2: Hydrogen flying testbed Do 228 [DLR]

Scope of the internship

The scope of the internship is to become familiar with high-technology simulation and testing tools used to design a complex electrical motor cooled with cryogenic hydrogen. The internship covers:

- Support of the Design of Experiment for axial flux engines
- Support for the development of an AI-based thermodynamic control loop of the cooling system
- Hydrogen safety assessment
- CFD / FE simulations and electromagnetic simulations of an axial flux engine
- Model-Based Systems Engineering (MBSE): Set up of model functions for the hydrogen cooling system

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The host of the project is the Material Resource Management (MRM) Building of the research group “HSA_comp”. Using a new-built laboratory for composite production and hybrid materials technology, a team of professors, PhD students, and Master's and Bachelor's students focus on Composite Design and Engineering.

Special requirements

The intern is interested in advanced materials and lightweight technology and has some basic knowledge of simulation and programming. AI and ML knowledge using PYTHON and MATLAB is an advantage.

The intern works in the Materials Resource Management (MRM) building.

Qualification level: Bachelor's Degree, Master's Degree

Program lines: SRI, A2S, BA/MA