Bachelor thesis, research internship, advanced seminar, or master thesis

Motor/Generator Design Optimization for a Drag Power Kite

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Motivation

Power generating kites have the potential to generate clean energy at a low cost competitive with coal power plants or cheaper without subsidies (see e.g. [1, 2, 3] and references therein). “Drag power” kites generate power with onboard wind turbines and generators by flying fast crosswind motions, see Fig. 1. Electrical power is transmitted to the ground at a medium voltage level via electric cables in the tether.

Figure 1: 20 kW “drag power” kite visualization of kiteKRAFT (image source: http://kitekraft.de/Images/20kWProduct.png, accessed: Aug 11, 2019).

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Tasks, Suggested Solution Approach, Expected Results

The eight gear-less motors/generators (electrical machines) of kiteKRAFT’s kite are currently standard low-voltage RC components, shown in Fig. 2. In the next generation kite, an optimized machine for the optimal DC link voltage of around 800 V shall be designed. Starting from a literature survey and sourcing information from electrical machine designers and manufacturers, an optimal machine shall be designed and a prototype shall be built and tested. Starting point is the literature list below and a longer literature list provided upon start of work. With the information gathered, a machine type shall be selected based on achievable performance characteristics (e.g. moment to weight ratio, power to weight ratio). An optimization model based on simple equations implemented in Matlab might be the next step. Further, a CAD model may be designed and a validation of the MATLAB results results in a FEM tool like COMSOL (mechanical and magnetic validation) may be conducted. Finally, parts for a prototype are ordered and the prototype is built and tested. Besides that key result, a report (could be the thesis) is required. This multidisciplinary task is supported by the members of the kiteKRAFT team.

Starting Point

This announcement, the literature list below, and additionally provided internal documents upon start.
Report and Presentation Guidelines

One report (or thesis) and at least one presentation of the results are required. Guidelines and templates can be downloaded from https://github.com/floba/StudentGuidelines.

Your Profile

This student work will be jointly supervised by the Institute for Electrical Drive Systems and Power Electronics and the TUM startup kiteKRAFT. The ideal candidate

- is a student in electrical engineering, mechatronics, or related fields,
- has good skills/background knowledge in machine design, FEM, electronics, MATLAB, Office, LaTeX,
- is motivated in the respective field of science and engineering,
- has good English and German language skills.

References


