

Master Thesis

Fully Redundant Ground Station Power Electronics for a Drag Power Kite

Contact/Applications to:

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Motivation

Power generating kites have the potential to generate clean energy with 10x less material demand and at a very low cost (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 with video link in the description. Electrical power is transmitted to the ground at a medium voltage level via electric cables in the tether.



Figure 1: Flying Kitekraft demonstrator. (Video available online: <https://youtu.be/42jvQpgfm94>, accessed: Jan 11, 2022).

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Tasks, Suggested Solution Approach, Expected Results

The TUM spinoff and project Kitekraft is developing and researching drag power kites. The power electronics is generally planned to be implemented with the concept presented in [4]. The current demonstrator power electronics does not fully implement this concept yet due to focus on other development steps. In this master thesis, the current demonstrator power electronics shall be extended to be fully redundant and grid-connectable. The detailed design concept shall also be evaluated in terms of costs, complexity and reliability for a 100 kW product version. Besides the documented hardware designs and setup, the master thesis as theory documentation and test reports are important outcomes. 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 project Kitekraft. The ideal candidate

- is a student in electrical engineering or related fields,
- has good skills/background knowledge in electronic circuit design, KiCAD or comparable software, math, MATLAB, Office, LaTeX,
- is motivated in the respective field of science and engineering,
- has good English and German language skills.

References

- [1] M. Loyd, "Crosswind kite power," *Journal of Energy*, vol. 4, no. 3, pp. 106–111, 1980.
- [2] U. Ahrens, M. Diehl, and R. Schmehl, Eds., *Airborne Wind Energy*, ser. Green Energy and Technology. Springer Berlin Heidelberg, 2013.
- [3] Kitekraft: Website, <https://www.kitekraft.de>, accessed: Jan 11, 2021.
- [4] Florian Bauer and Ralph M. Kennel. "Fault Tolerant Power Electronic System for Drag Power Kites". In: *Journal of Renewable Energy (Hindawi)* 2018 (Apr. 16, 2018). doi: 10.1155/2018/1306750. url: <https://www.hindawi.com/journals/jre/2018/1306750/> (visited on Apr. 17, 2018).