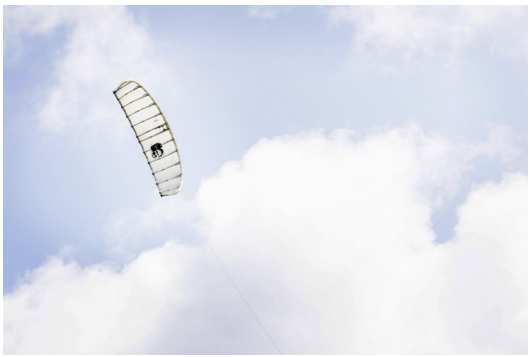
Student project and Master Thesis
Informatik/ESE/MST/MSE/SSE

Modeling and System Identification of a Kite Power System



Airborne Wind Energy (AWE) offers a revolutionary approach to harnessing wind power by using tethered aircraft. AWE systems can access stronger, more consistent winds at higher altitudes than traditional wind turbines, presenting a promising avenue for future renewable energy generation. One compelling AWE technology is the rigid-wing kite-based system developed by the company Kitepower B.V. (see image). Kitepower is headquartered in Delft, Netherlands, and is collaborating with Prof. Moritz Diehl's Systems Control and Optimization Laboratory at the University of Freiburg on an industrial master thesis opportunity.

A critical challenge for autonomous operation of the kite is the flight path control during all operating phases. Optimization-based control approaches provide a flexible and effective way of tackling this problem. One of the challenges of such approaches is that they require a model (a “digital twin”) of the kite power system. This model should be an accurate representation of the system dynamics, while also being suited for efficient numerical optimization. Building on previous research in Freiburg and Delft, this master thesis aims to create a digital twin of Kitepower’s kite system, using operational data obtained from real-world flight tests.

Master topic: The proposed master thesis will develop a model to be used in optimal control of a Kitepower system. The thesis will first focus on the development of a simulation model to accurately represent Kitepower's soft-wing kite design, control mechanisms, and operational parameters. In a second step, the model parameters will subject to an identification procedure using actual sensor data from Kitepower’s kite system. For conceptual validation, the developed model shall be used to formulate and solve basic trajectory optimization problems for flight path planning. This master thesis offers the opportunity to contribute to the cutting edge of AWE technology, with the potential for real-world impact on the development of commercial Kitepower systems.

Your skills: Prior knowledge in systems and control as well as programming skills (Python/Matlab, CasADi) are necessary.

Compensation: Part of the thesis will be carried out in Delft in the simulation team of Kitepower B.V. Travel expenses will be covered by Kitepower.

Supervisors and contacts:
Dr. Jochem De Schutter and Prof. Dr. Moritz Diehl

If you are interested, please feel free to contact
Jochem De Schutter <jochem.de.schutter@imtek.uni-freiburg.de>

Department of
Microsystems Engineering

Systems Control and
Optimization Laboratory

University of Freiburg

Prof. Dr. Moritz Diehl

Georges-Koehler-Allee 102
79110 Freiburg

phone: +49(0)761/203-67852

moritz.diehl@imtek.uni-freiburg.de
www.syscop.de
www.imtek.de

Freiburg, 06/25/2024