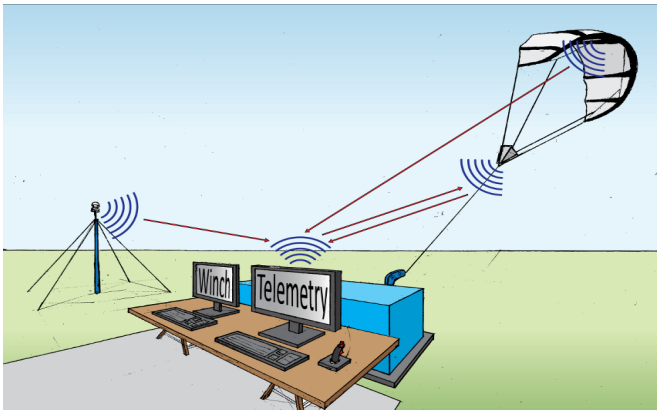
MSc-thesis assignment **ASSET Institute, TU Delft**

Development of a real-time kite-power system simulator



The increasing pressure to develop renewable transportation and energy solutions has lead to a renewed interest in kites. Especially over the last decade, a variety of kite-based concepts for ship propulsion and electricity generation have been proposed. The current demonstrator system of TU Delft is based on a ground station of 18 kW power using kites of different sizes (6 m^2 to 50 m^2 surface area) in "pumping" operation (reel-out / reel-in phases). The ground station comprises a motor/generator unit connected to a drum.

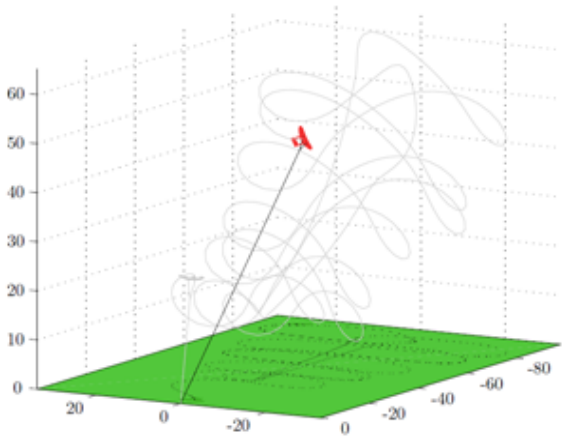
The objective of this research project is to develop a real-time model of the current kite-power system. It shall be used for the training of new pilots and winch operators, but also for the test and optimization of automated control systems. Many of the needed components already exist, but they have to be verifyed with tests and measurement data, and they shall be integrated into the DKCS (distributed kite control software) framework.

Research questions

- How can a model of a system with a structure, that is constantly changing be build in such a way that the kite or the winch or the tether model can easily be exchanged?
- Which DAE solvers are suitable for finding a stable solution in real-time?

Tasks

- Study the way, how existing flight and kite simulators are implemented.
- Study the existing software components and algorithems.
- Improve and verify the existing, simple real-time kite model.
- Implement a real-time viewer component, to visualize the flight of the kite (C++/ QT)



Visualization of the pumping cycle of a kiteplane

- Implement a real-time interface to the existing RC-control so that it can be used to steer the kite model.
- Integrate the new and the existing components (winch, kite, tether, winch controller, wireless link model)

Recommended skills

- Basic knowledge physics, electronics and mechanics
- Basic knowledge of programming; readiness, to aquire basic C++ knowledge
- Basic knowledge of solving Differential-Algebraic Equations (DAEs)

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