

## Pitch Control of a Roto-Kite



Airborne Wind Energy (AWE) is a novel way to harvest wind power by flying devices. AWE can harvest winds in higher altitudes than conventional wind turbines and promises to become a major source of renewable energy in the future energy system. One possible AWE approach is based on roto-kites as pursued by the Spanish company someAWE Labs S.L. (see picture above). This company is located in Alicante and offers an industrial master thesis in close cooperation with the team of Prof. Moritz Diehl from the Systems Control and Optimization Laboratory of the University of Freiburg, who will be the academic supervisor. A major task for the automatic flight of roto-kites is the control of the position of the device in the sky, which can be achieved via cyclic pitch control of the blades, somewhat similar, but not exactly, to helicopter control. In a previous ESE master thesis, a Cyclic Pitch Controller was realized both in theory and experiment. The next goal is to develop a rotor that combines collective and cyclic pitch.

**Master topic:** The proposed master thesis shall build on the previous work in Freiburg and Alicante and realize an embedded control system for pitch control of a roto-kite and test it with different pitch mechanisms on a test stand and, if successful, on a new rotor. The task of the embedded controller is to accept inputs from a human-controlled remote control (RC) system (collective pitch angle, cyclic pitch amplitude, and cyclic pitch phase) and to translate these to individual pitch motor commands, in order to be able to steer a real roto-kite device by RC-control on the sky.

**Your skills:** Prior knowledge in systems and control as well as programming skills are necessary, and experience with Arduino systems could be a useful starting point. Most important is the willingness to make a real-world embedded control system including sensors and actuators work.

**Compensation:** During your stay in Alicante someAWE Labs will pay for travel expenses, room and board

**Supervisors and contacts:**

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Freiburg, 11/24/2023