



Florian Bauer

PhD Researcher Technische Universität München Department of Electrical Engineering and Information Technology

Visiting PhD Researcher University of California, Irvine The Henry Samueli School of Engineering Department of Electrical Engineering and Computer Science

> 3201 Engineering Hall Irvine, CA 92697-2700 U.S.A.

> florian.bauer@tum.de



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Technische Universität München

On Multicopter-Based Launch and Retrieval Concepts for Lift Mode Operated Power Generating Kites

Florian Bauer¹, Christoph M. Hackl², Keyue Smedley³, Ralph Kennel¹

¹Institute for Electrical Drive Systems and Power Electronics, Technische Universität München ²Control of Renewable Energy Systems, Munich School of Engineering, Technische Universität München ³The Henry Samueli School of Engineering, Power Electronics Laboratory, University of California, Irvine

"Lift mode" operated kites [1] are a promising alternative to conventional wind turbines and "drag mode" operated kites [1], as the generator is located on ground. A key challenge of this technology is the fully automated, and safe launch and retrieval. Several ideas exist, e.g. [2, 3, 4, 5], and are pursued by major players, but most concepts rely on a material intensive and complex ground station and/or on strong and constant winds nearby the ground. With the goal to overcome those disadvantages, in this talk we explore multicopter-based concepts for lift mode kites.

The two sequences depicted on p. 92 illustrate the idea of the launching (top left) and landing (bottom right) of a soft kite with a multicopter control pod: powered by onboard batteries, the pod hovers downwind and upwards while the kite hangs below and the tether is slack. Hereby the leading edge of the kite faces towards the wind vector and thus the kite has similar controllability as if it would be in the zenith. Then, the tether is pulled by the ground winch to erect the kite. Finally, the propellers are turned off, the kite is turned over and power generation is started. During crosswind flight the propellers are used as turbines to power onboard electronics and to recharge onboard batteries. For the retrieval the kite is flown from the zenith towards the ground with reduced speed by depowering. Then, the propellers are turned on with high thrust, while the tether length is kept constant or the tether is slack. The pod starts to hover in constant altitude and the kite swings below. Finally, the pod hovers back to a landing site. This concept has following advantages: (i) a simple ground station, (ii) no need for wind nearby the ground, and (iii) applicability to attach several kites to a split tether. However, several challenges must be faced like complex flight manoeuvres or the increased mass due to the batteries. In this talk, those concerns are addressed and solutions are explored. Promising dynamic simulations suggest the feasibility of the flight manoeuvres. Furthermore, extensions and applicability of multicopter-based concepts for lift mode rigid kites are discussed.

References:

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