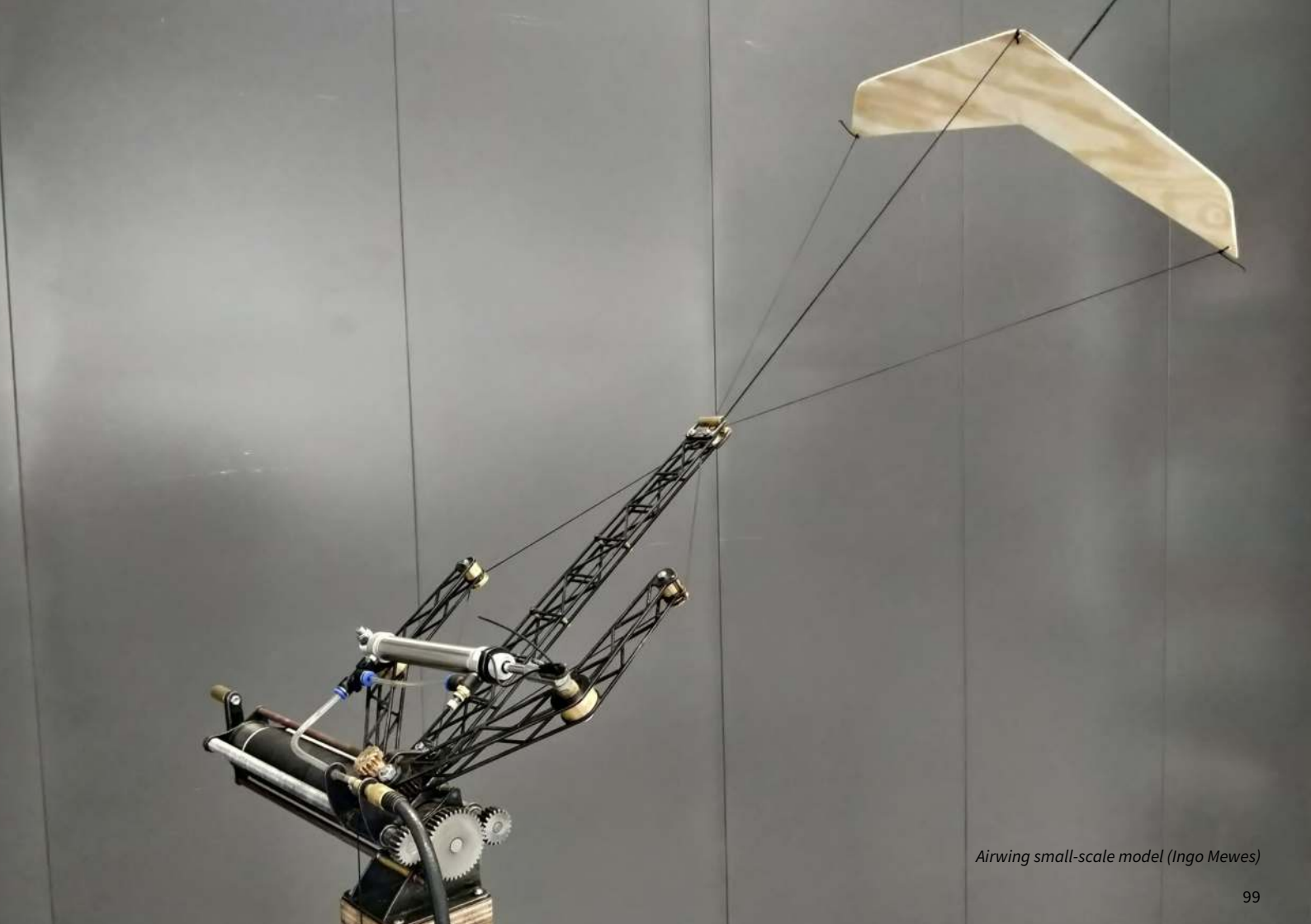

Airwing small-scale model (Ingo Mewes)

Airwing steering mechanism (Ingo Mewes)

AirWing, a Self-Regulating Control System for Kites

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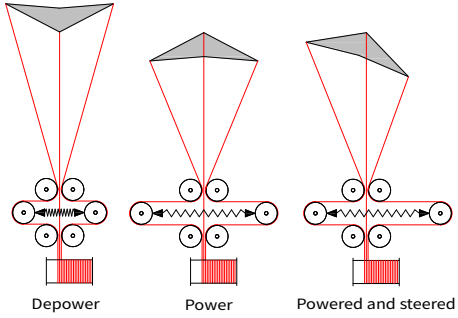
One of the major challenges for reliable and safe operation of kites is flight control. In my study I present an innovative control concept, suitable for marine propulsion and power generation. Compared to existing control systems, my development differs in three main points: simple and robust mechanical design (the basic functionality can be ensured even without electricity); for take-off, landing and cyclic power generation only one common winch for all lines is needed; a flying control unit is not required.

As shown in the figure, AirWing is a part of the ground station. It consists essentially of six pulleys, four fixed and two mounted on a movable air spring element. The force, the damping and the stroke of this spring can be adjusted individually. This makes it possible to adapt the system to different kites and flying conditions. All control commands and load-dependent self-regulation are thus performed from the ground. The fact, that the kite is always connected to the ground station by three lines increases operational safety. The central main tether connects the kite directly to the winch, while the less stressed control lines are routed around the spring element. By spreading the control lines, and moving the spring element horizontally, the kite can be trimmed and steered. The preset spring force limits the maximum tension of the control tethers; in case of higher pulling forces on the control tethers, they are automatically lengthened. This leads to an immediate depowering of the kite at the event of temporary overload.

The entire system is thus self-regulating, and can be safely operated at the power limit even in gusty winds, which can improve efficiency. Despite the simple mechanical design, the system can also be operated with a digital autopilot. So the system I will present can help to operate airborne wind energy systems in a safe, cost-effective and reliable manner.



AirWing concept

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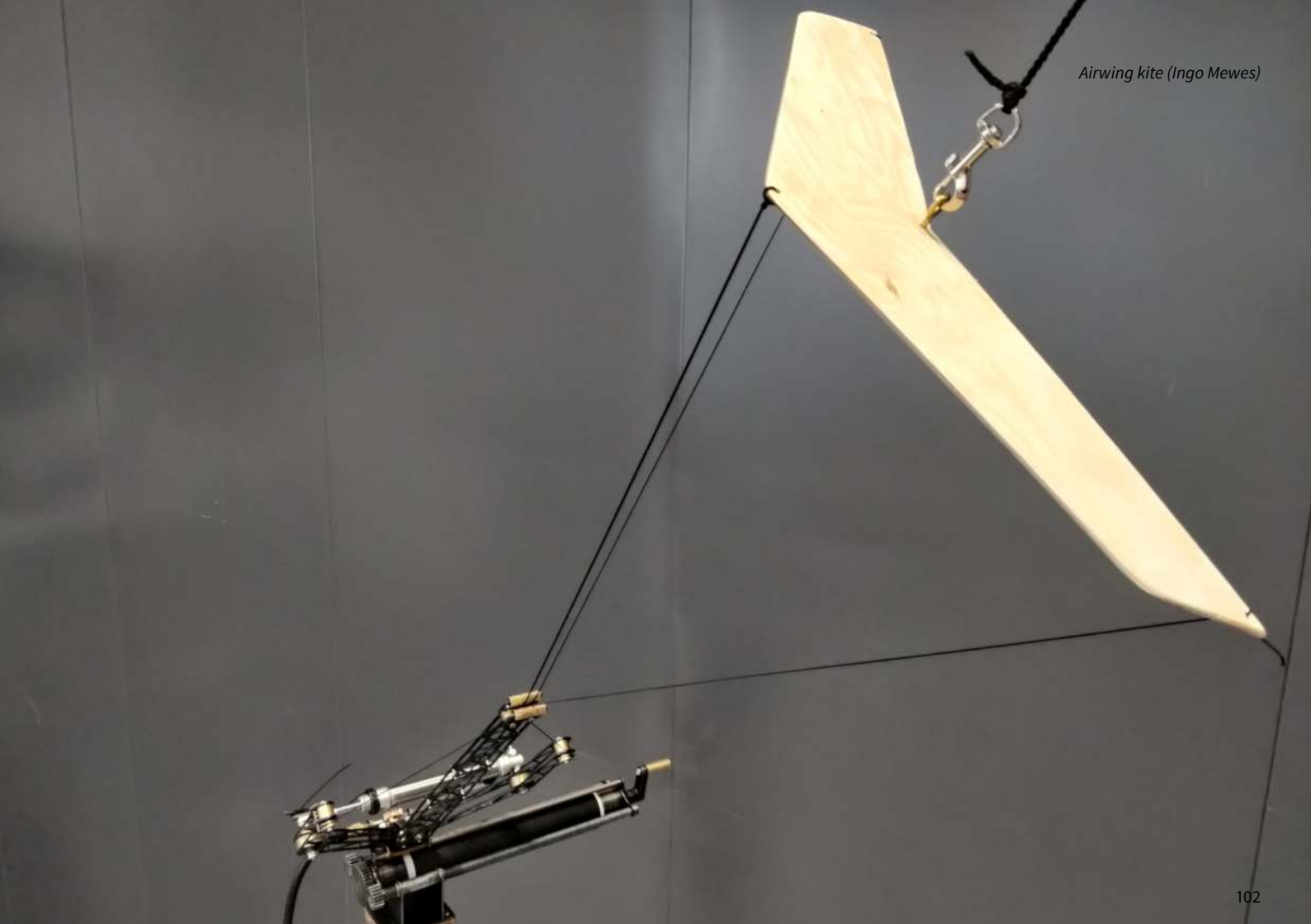
[1] Bormann A., Ranneberg M., Kövesdi P., Gebhardt C., Skutnik S.: Development of a Tree-Line Ground-Actuated Airborne Wind Energy Converter. In: Ahrens U., Schmehl R., (eds) Airborne Wind Energy and Technology, Springer, Berlin, Heidelberg 2013.

[2] Mewes I., Steuereinrichtung für seilgebundenes Fluggerät, Verfahren zur Steuerung von Fluggerät. Patent File number: DE 10 2020 131 131 A1.



Airwing kite (Ingo Mewes)