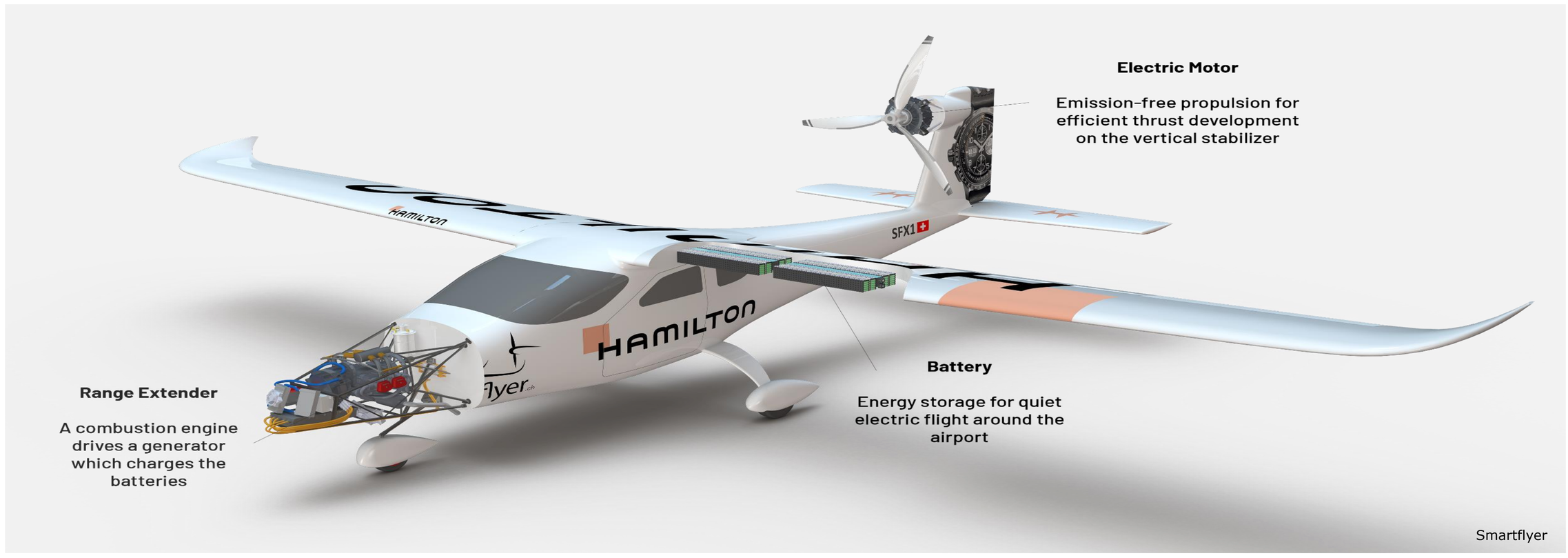
Technik & Architektur
Institut für Elektrotechnik, Energie- und Antriebssysteme
Master-Thesis Elektrotechnik

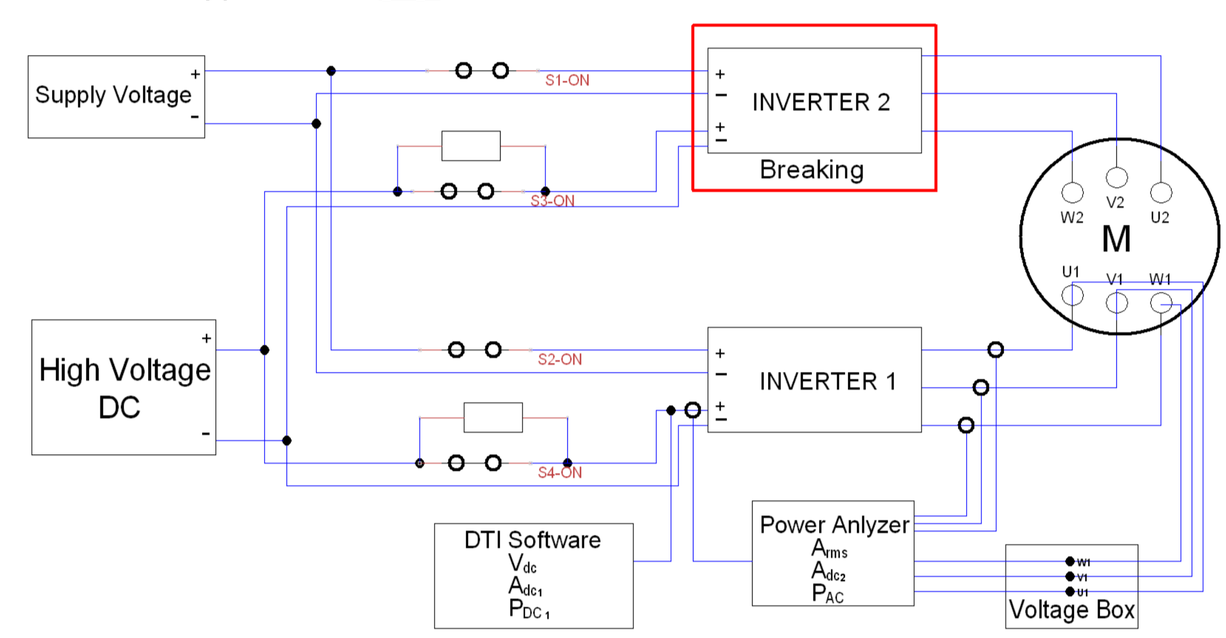
Master of Science in Engineering, Specialization in Electrical Engineering

Dual-Wound Electric Motor for Aviation

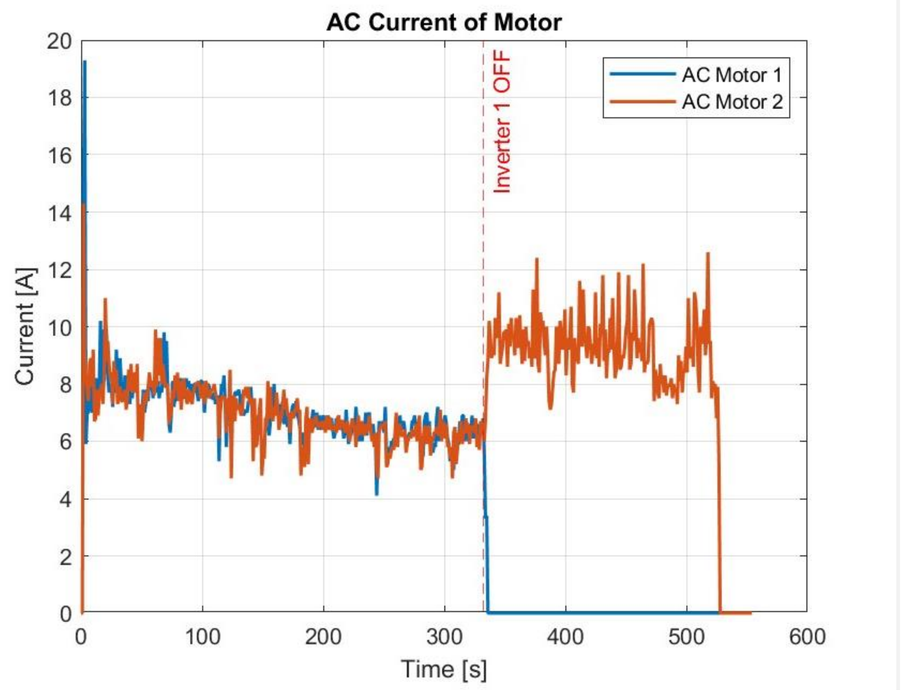
Doppelwicklungs-Elektromotor für die Luftfahrt



SFX1 Prototype Model [1]



Test bench for measurement of Power Losses



Measurement for Test Case

Problem

To obtain the necessary permit for the aircraft to take flight, it is important to that the aircraft can effectively handle any potential issues arising from inverter failures. This capability is essential for ensuring the safety and well-being of both the pilots and passengers.

Inverter failures can lead to significant operational challenges, and demonstrating the aircraft's ability to manage such failures is a key requirement for regulatory approval. To address this requirement, a comprehensive series of tests is conducted on no load condition. These tests specifically focus on evaluating how the aircraft's systems respond in the event of an inverter malfunction.

The primary goal is to determine if the inverter and motor can handle this situation, identify power losses under these testing conditions, and find new ways to improve performance in real operational scenarios.

Solution Concept

To monitor the variations in voltage and current, a dedicated test bench has been established where different scenarios are tested. For the power loss analysis, the test bench is equipped with a power analyzer. To verify these measured power losses, additional measurements are taken from the cooling system. This setup ensured for the verification of the power loss.

Results

Testing the system across six conditions revealed key performance insights. Under normal conditions, both inverters worked as expected, ensuring dependable operation. The system also functioned well with one inverter during partial failures.

An important finding was the need to reset the throttle to zero if one inverter loses power, highlighting the need for clear pilot instructions. The system resumed to normal operation even if high voltage was not present during operation without needing a throttle reset.

Power loss measurements showed both inverters performed similarly, with Inverter 2 having slightly lower and more stable losses. Approximately 62% of the total power loss was converted to heat into the colling, aligning with power analyzer estimates. Future tests should include full load conditions with a propeller to assess real-world performance.

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[1] Smartflyer — Electrical Aircraft made in Swiss