



**Task Description Bachelor's Thesis/ Master's Thesis**  
**Development of a Thrust Balance Control System for the 5 kW AF-MPD Thruster**  
**SUPREME**



Boxberger A, Behnke A and Herdrich G, 2019. Current advances in optimization of operative regimes of steady state applied field MPD thruster. 36th IEPC (Vienna).

Motivation:

The EU project *Superconductor-Based Readiness Enhanced Magnetoplasmadynamic Electric Propulsion* (SUPREME) aims to enhance the flight readiness of applied-field magnetoplasmadynamic (AF-MPD) thrusters by successfully integrating a high-temperature superconductor (HTS) coil in conjunction with a radiatively cooled anode for an AF-MPD thruster operating in the 5 kW power range. As part of this endeavor, a prototype is currently under development for comprehensive testing and evaluation at the Institute of Space Systems (IRS) in collaboration with the consortium partners Airbus CRISA, University of Twente, Neutron Star Systems and PEAK Technology. To comprehensively characterize the operational envelope of the SUPREME thruster, an inverted-pendulum thrust balance is currently under development for integration into the testbench. The thrust balance incorporates multiple motor-driven measuring systems for precise thrust measurement. The design further includes auxiliary components such as a levelling unit, a locking mechanism, and a calibration unit. The primary objective of this work is to develop a control system for the thrust balance and to mechanically optimize the thrust measurement procedure. This control system will facilitate highly accurate measurements and enable precise alignment of the thruster. Moreover, it will oversee and regulate the calibration measurements of the thruster with a calibration method developed as a part of this work.

Task Description:

- Familiarization with AF-MPD thruster technology and thrust measurement methods
- Identification of measurement requirements and boundary conditions
- Optimization of thrust measurement methods
- Design of a calibration unit for the thrust balance and definition of calibration procedures
- Design of a control system for calibration and thrust measurement
- Documentation

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