

Master Thesis

Experimental investigation of wear on lunar rover wheel-mounted sensors

experimental thesis

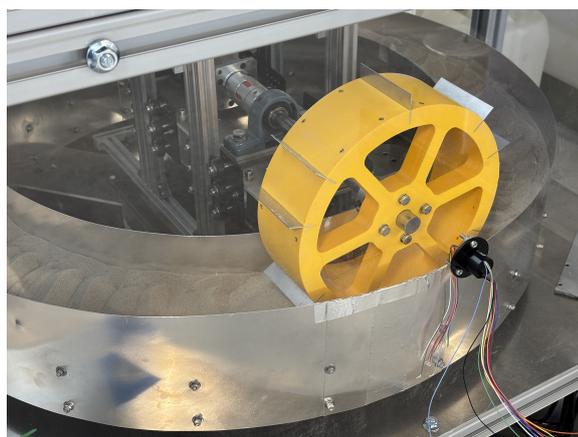
Start date: immediately possible

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Topic:

The Rover Permittivity Sensor (RPS) is an instrument, built by TUM, to be integrated into the wheel of the Rashid-3 rover from MBRSC (UAE) and is expected fly to the Moon in 2029. RPS aims to map water content in the lunar subsurface along the rover's track.

To qualify the RPS sensor design, it needs to be tested for wear in a simulated lunar environment. The test setup has already been built and commissioned for room temperature tests with a wheel prototype (see figure). The setup has a rotating track with interchangeable simulated lunar regolith surface and a rotating wheel to allow testing wear at different slip conditions. The wheel has a gravity offloading system for simulation of lunar gravity. This thesis will implement already planned changes for testing at cold temperatures (liquid nitrogen cooling) and test the wheel with sensors in different environments (temperatures, regolith simulants, surface roughness).



Tasks:

- Familiarization with the test setup and the theoretical background.
- Adapt the setup for LN2 cooling incl. a new metal wheel with cooling and temperature sensors.
- Improve experimental methodology for sample handling, surface resetting and data acquisition (temperature, wheel force, camera).
- Investigate wear properties of RPS sensor caps at different temperatures and simulated surface properties.
- Analyze the tested samples (microscopy, surface shape and roughness measurement) and draw conclusions for sensor cap design and its suitability.

Requirements:

- Basic programming in Matlab or Python for data acquisition and analysis.
- Experience with CAD and drafting for manufacturing (Solidworks or NX).
- Basic experience with motor control and measurement electronics.
- Willingness for hands-on lab work in Ottobrunn.
- Bonus: Experience with regolith simulants, soil mechanics or liquid nitrogen.

Supervisor:



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