



## Bachelor Thesis

# Investigation of the effective emissivity of non-isothermal cavities for radiation thermometry

*Starting Date:* October 2023

### *Motivation:*

During atmospheric entry of spacecraft, extensive heat loads are acting on the Thermal Protection System (TPS). Knowledge about the material behavior in the apparent plasma environment is crucial for the selection of suitable materials and structures. For this purpose, the Institute of Space Systems conducts Plasma Wind Tunnel (PWT) experiments in dedicated ground testing facilities. Since thermochemical processes on the surface, such as oxidation and heterogeneous catalysis, are temperature dependent, exact measurements of the surface temperature are necessary. A linear pyrometer is used to determine the backside temperature of material samples during PWT experiments by measurement of the infrared thermal radiation. The pyrometric measurement method is especially suitable for high temperatures but relies on the knowledge about the emissivity of the sample surface. In order to mitigate the emissivity dependence, a highly reflective cavity shall be used to manipulate the effective emissivity of the sample. For the optimization of the cavity geometry and surface, as well as the determination of the cavity's effective emissivity, numerical simulations shall be performed.

### *Task:*

- Introduction to thermal radiation, pyrometry and cavity effects
- Programming of a non-isothermal rotationally symmetric cavity code in MATLAB (or similar)
- Investigation of suitable geometries, materials and coatings of the cavity
- Verification of simulation code
- Documentation

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