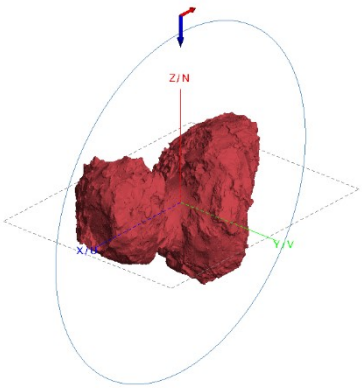
Fakultät für Luft- und Raumfahrtechnik
Institute of Space Technology & Space Applications
Professur für Raumfahrttechnik LRT 9.1
Univ. Prof. Dr.-Ing. R. Förstner

der Bundeswehr Universität München

Electromagnetic simulation of bistatic RADAR scattering from planetary surfaces

Bachelor-/Project-/Master Thesis

Orbital Bistatic RADAR (BSR) is a technique used in radio-science experimentation to probe the surface of planetary bodies. In its most frequent downlink configuration, the spacecraft transmits the telecommunications carrier signal towards the body, while a receiver on Earth records the echo from the surface. The power ratio between the incident and the scattered wave is known as the target's radar-cross section (RCS).



The RCS is a function of the effective permittivity of the surface material mixture, its roughness, and the bistatic angle. Forward modelling of a target's RCS to match in-situ observations is a method to infer the bulk density and porosity of potential material mixtures.

The aim of this thesis is to model the RCS of selected regions at Mars or alternatively at comet 67P/Churyumov-Gerasimenko. The asymptotic solver "Ray-Launching Geometrical Optics" (RL-GO) available from the commercial software FEKO should be used.

Objectives

- Characterize the performance of RL-GO on reference objects: sphere, ellipsoid, …
- Set up of a realistic BSR simulation scenario within FEKO: transmitter/receiver relative geometry, antenna radiation pattern, target shape, and target surface properties.
- Perform a simulation campaign for an scenario of choice (Rosetta or Mars Express).
- Validate the results against real mission data.

Recommended Knowledge

- Basic electromagnetics and general interest in planetary research.
- No programming skills are required, but some basic scripting could be of use.

Literature

1. FEKO Webinars (See RCS tutorial for military ship, Software is available via WTS)
2. "Polarization in bistatic radar probing of planetary surfaces", R.Simpson et al., 2011.
3. "Ray-Launching Geometrical Optics in FEKO", A.G. Aguilar and U. Jakobus, 2018.

Supervisor contact details

M.Sc. **Graciela González Peytaví**
E-mail: graciela.gonzalez@unibw.de
Tel: +49 89 6004 4830
Building 35, Raum 1406

Dr. **Thomas P. Andert**
E-mail: tom.andert@unibw.de
Tel: +49 89 6004 3598
Building 35, Raum 1403