Characterising the optical channel between ground and space

MSc thesis performed at the Deutsches Zentrum für Luft- und Raumfahrt (DLR), Oberpfaffenhofen, in partnership with the Industrial Mathematics Institute, JKU, Linz

The Deutsches Zentrum für Luft- und Raumfahrt (DLR) is offering, in partnership with JKU, a position within which the selected student completes the work for their MSc thesis. It is expected that the student works at the DLR site in Oberpfaffenhofen (approximately 30km outside of Munich). The work will be jointly supervised by the Institute of Communications and Navigation, DLR, and the Industrial Mathematics Institute, JKU.

Project description:

Ground-space laser communications enables data rates many orders of magnitude greater than conventional techniques. This technology is referred to as Free-space optical communication (FSOC) and during space-to-ground links involves spacecraft sending a communications laser signal towards an Earth-based telescope. It is believed that FSOC will lead the way towards future generations having worldwide high-speed internet access. Another driving force is that the realisation of this technology would transform deep space exploration.

Optical wavefronts from a celestial source propagate freely through outer space. It is only in the last fraction of their journey towards the Earth – where they propagate through atmospheric turbulence – that they become perturbed. These aberrations are so severe that they prevent optical ground-space links from being established. One of the most promising solutions for mitigating the effects of atmospheric turbulence is Adaptive Optics (AO) – a real-time technology that corrects for wavefront aberrations. The wind drives atmospheric turbulence. Therefore, these AO systems must be updated thousands of times per second. Optimal AO control is a crucial inverse problem.

The project will focus on optimising AO system performance for FSOC. Its research topics will cover techniques for characterising the effects of atmospheric turbulence. A core activity will be the development and analysis of mathematical models and algorithms. DLR has already developed a number of sophisticated instruments that have taken data at world-leading observatories. The student will be tasked with further developing existing software tools for analysing this data. They will have access to advanced simulation software and high-performance computing hardware. It is hoped that they will support scientific measurement campaigns, and use this opportunity to test their developed concepts on-sky. Novel ideas will be encouraged.

Activities:

- theoretical analysis and mathematical modelling of optical wavefront propagation
- development and performance analysis of novel algorithms
- evaluation of analysis of the results
- concise presentation of results and further ideas

- possible participation in on-sky measurement campaigns
- work in a team of experienced AO scientists from DLR and JKU

Your qualifications:

- understanding of mathematical modelling and inverse problems or
- understanding of optical propagation and wavefront modelling
- experienced in Matlab and/or Python programming language

Your benefits

Look forward to a fulfilling job with an employer who appreciates your commitment and supports your personal and professional development. Our unique infrastructure offers you a working environment in which you have unparalleled scope to develop your creative ideas and accomplish your professional objectives. Our human resources policy places great value on a healthy family and work-life-balance as well as equal opportunities for persons of all genders (f/m/x). Individuals with disabilities will be given preferential consideration in the event their qualifications are equivalent to those of other candidates.

Organisations

Johannes Kepler University, Linz, Austria, and Deutsches Zentrum für Luft- und Raumfahrt (DLR), Oberpfaffenhofen, Germany

Duration of contract

6 months

Remuneration

up to the German TVöD 5

Type and location of employment

Full-time (part-time possible) based at the DLR site in Oberpfaffenhofen

Technical contact

Dr. Douglas Laidlaw
Institute of Communications and Navigation (DLR)
Phone: +49 8153 28-4522
douglas.laidlaw@dlr.de

Dr. Victoria Hutterer
Industrial Mathematics Institute
Johannes Kepler University
victoria.hutterer@indmath.uni-linz.ac.at

Application to

office@indmath.uni-linz.ac.at

More information found

https://www.dlr.de/dlr/jobs/en/desktopdefault.aspx/tabid-10596/1003_read-51490/