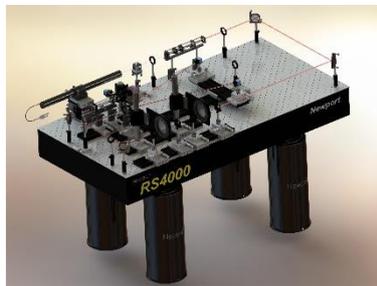


Department Signatorics at the Fraunhofer Institute for Optronics, System Technology and Image Exploitation (IOSB) in Ettlingen is offering an internship on the subject of free-space laser communications. Target group are students in the fields of electrical engineering, physics, computer science or similar.

Laboratory Demonstrator for Wavefront Sensorless Adaptive Optics

The internship would be based in the Adaptive Optics Group where research themes revolve around imaging through turbulence (especially along horizontal paths and strong turbulence) and free-space laser communications. The team develops simulations, theoretical models, image processing software and adaptive optics systems.

More information about the Adaptive Optics Group at Fraunhofer IOSB can be found under www.iosb.fraunhofer.de/adaptive-optics



Motivation

Free-space (not cable/fiber-dependent) optical communications offers a huge potential for many applications involving the transfer of large amounts of data. Still, the limitations imposed on the deployment of such systems by atmospheric effects are significant. In the department Signatorics we work to counter these effects and enable high-data-rate terrestrial and space-to-ground optical communications.

Putting aside completely disruptive phenomena such as rain or fog, atmospheric turbulence influences the power delivered to the terminal and the number of errors in the transmission. Fraunhofer IOSB addresses the problem with advanced adaptive optics (AO) technology. In the AO laboratory in Ettlingen we develop solutions to the most challenging problem of laser propagation over distances longer than ~ 1 km through strong turbulence near the ground. The effects encountered over such paths are quite different from those faced by astronomical AO, and therefore unconventional approaches to the problems must be developed.

Goals

Traditional AO systems have three main components: a wavefront sensor, a deformable mirror and a reconstruction computer. Wavefront sensorless AO dispenses of the first element and relies on blind optimization algorithms to improve a suitable metric related to the turbulence degradation of the optical system under consideration. The most widely used algorithm in wavefront sensorless AO is the stochastic parallel gradient descent (SPGD). In the project, the student will work on a lab demonstrator to investigate the capabilities of wavefront sensorless AO.

With questions about this project please contact:

Dr. Szymon Gladysz

Adaptive Optics Group Leader

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Tasks

- You will be supplied with an optical testbed and software (Matlab and LabView) for wavefront sensorless AO. The setup features a spatial light modulator to generate defined, artificial turbulence, and a deformable mirror as a correction device. After getting familiar with the core components of the experiment, you will be tasked to align the setup and close the AO loop.
- You will be asked to integrate a calibration procedure for the deformable mirror in the setup.
- You will be tasked with the adaptation of the testbed into an operational lab demonstrator. For this purpose, meaningful live experiments should be designed and user-friendly interface and control implemented.

What we expect from you

- You are enrolled in a college or university and study electrical engineering, physics, computer science or a similar subject.
- You have experience with the Matlab programming language; experience with LabView would be helpful.
- You know the principles of optics and laser physics.
- You have a hands-on mentality and some experience with aligning optical systems.

What you can expect from us

- You work on current scientific questions that are highly relevant to the scientific community.
- You will have access to exceptionally equipped laboratories, with several unique, not commercially available devices. Details of the equipment can be found under <https://www.iosb.fraunhofer.de/en/competences/optronics/signatorics/adaptive-optics/laboratory-equipment.html>
- You will be supervised by experts in the fields of: turbulence, telecommunications and laser physics.

The position is temporary. The duration of the internship must correspond to the required duration imposed by the sending university.

In case of identical qualifications preference will be given to severely disabled candidates. We would like to point out that the chosen job title also includes the third gender. The Fraunhofer-Gesellschaft emphasizes gender-independent professional equality.

Information about the Institute can be found under <http://www.iosb.fraunhofer.de>.

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