Gisela and Erwin Sick Chair of Micro-Optics

Prof. Hans Zappe

Research Area
Optical Microsystems

Relevant Tasks
☒ Optical experiments
☒ Test setup development
☐ Device characterization
☐ Material characterization
☒ Optical simulations
☐ FEA simulations
☐ Clean room fabrication
☒ CAD/CAM
☐ Polymer fabrication
☐ Programming
☒ Analytical analysis / Theory
☒ Literature research
☐ Teaching

Eligible Departments
☒ Microsystems technology
☒ Mechanical engineering
☒ Process engineering
☐ Chemistry
☒ Physics
☐ Electronics and IT
☐ Computer science
☐ Industrial engineering

Requirements
Ability to work independently

Basic optics knowledge

Starting Date
Immediately

Contact Person
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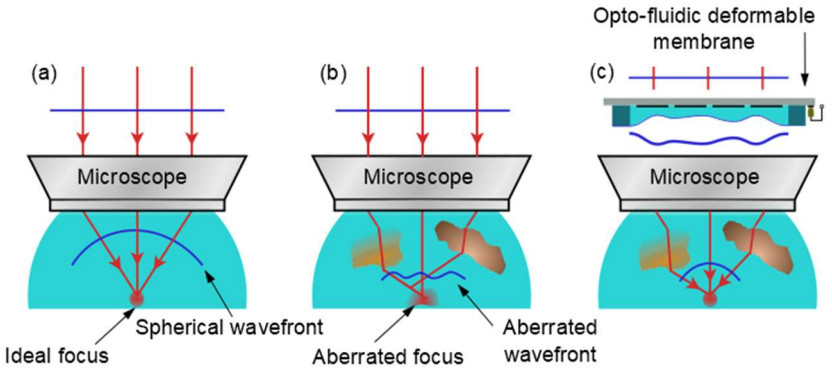
Master's Thesis

Integrating adaptive optics into a commercial microscope

Adaptive Optics is a technique that aims to dynamically track, and subsequently correct for the wavefront errors present in image formation. Conventional adaptive optics systems are composed of a wavefront modulator in form of a deformable mirror, a wavefront sensor and a real-time controller. In Gisela and Erwin Sick chair of Micro-optics we have developed a new adaptive optics system including a novel opto-fluidic refractive wavefront modulator, a real-time control system and a sensorless aberration estimation algorithm to replace the conventional wavefront sensors. This new system is particularly suitable for a plug-and-play extension for commercial microscopes, and this is precisely what this project is about.



Effect of inhomogeneity of sample refractive index on the imaging properties of a microscope objective. (a) Formation of an ideal focus in the absence of aberrations. (b) Incoming at wavefront gets aberrated because of differences in refractive indices. (c) The wavefront is corrected before image formation by applying the conjugate of the phase of the aberrations by help of the wavefront modulator.

Here is what is expected from the prospective student:

- Design of a simple optical system to be plugged between the camera port and the camera of the microscope using ray-tracing simulations,
- Implementation of the designed system on a commercial microscope and integration of a wavefront modulator into the extended system,
- Documentation of the aberration correction performance of the integrated system through detailed imaging experiments.

The prospective candidate will have the chance to join a highly motivated team working on various aspects of static and dynamic waveform shaping. The candidate will be assisted by the team all along the project.

If you are interested in further information, please contact Dr. Çağlar Ataman.