Laboratory of Micro-optics

Prof. Hans Zappe

Research Area
Optofluidics

Relevant Tasks
☒ Electronics Design
☒ 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

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

Requirements
Ability to work independently

Electronics knowledge
Basic optics knowledge

Starting Date
Immediately

Contact Person
Daniel Sauter
Room: 102 02-077
Tel: 0761/203-7574
Daniel.Sauter@imtek.de

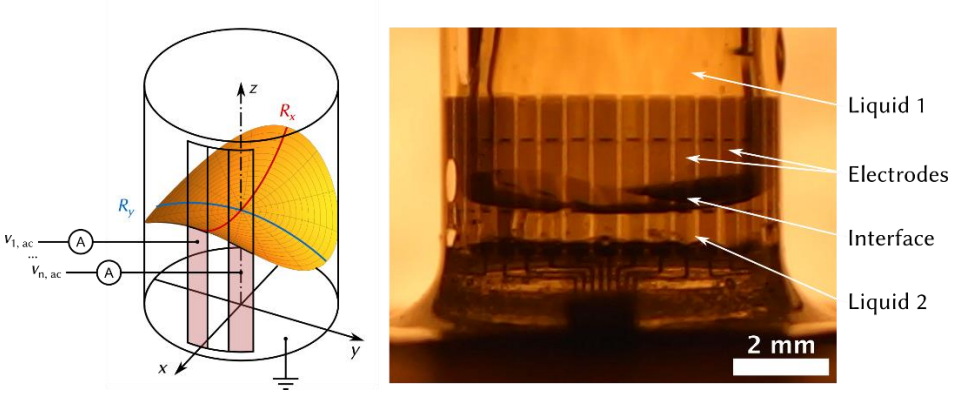
Master's Thesis

Development of an Intrinsic Electrowetting Feedback Mechanism for Optofluidic Devices

The Laboratory of Micro-optics specializes in development and manufacturing of various soft-matter optical components such as tunable liquid lenses, prisms, apertures and zoom systems.
In this project, you will be working on our Electrowetting-actuated liquid device family. By combining two immiscible liquids, the resulting interface can be used as a deformable refractive component. Through Electrowetting-on-Dielectrics, the shape of this surface is dynamically changed to perform varying optical functions such as spherical and cylindrical lenses, prisms and phase modulators. We aim to further improve on this established technology by implementing a feedback mechanism that provides information about the liquids shape during operation. Due to the capacitive nature of our devices, monitoring of the electric current provides direct information about the electrode area. Hence, the main task of the project will be the development of a current measurement circuit for the continuous monitoring of up to 64 channels with high resolution. Using this feedback to implement and demonstrate closed-loop operation is the ultimate goal of this project.

The project encompasses the full spectrum of tasks starting from literature research and theoretical analysis, all the way to operation and characterization of the finished device. The first task will be a theoretical analysis, followed by COMSOL/LTSpice simulations which will help define the hardware requirements. Based on these requirements, one or more measurement concepts will be developed and tested on a small scale. The next step will be the realization of the chosen concept at full scale and integration with an existing device. Characterization of the complete setup and demonstration of closed-loop operation conclude the project.

The estimated project duration is 6 months. If you are interested in the project and would like further information, please send an email to Daniel.Sauter@imtek.de including a CV and current transcript of records.



Left: Conceptual schematic of the working principle. Each electrode will be partially covered by liquid (red) which will change the capacitance. This capacitance change will lead to a variation in measured current to that electrode. Right: Image of the used device with an interface that is momentarily shaped to form a cylindrical lens.