Master Thesis:

Design of a high-Q silicon organic hybrid (SOH) racetrack modulator operating at 300 GHz

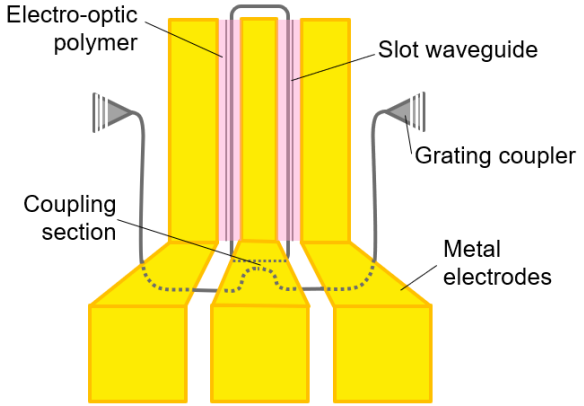
An electro-optic (EO) racetrack modulator operating at 300 GHz has immense potential for high-speed optical communication and novel THz applications, such as next-generation 6G network and ultrafast spectroscopy.

The proposed modulator is a silicon organic hybrid (SOH) racetrack modulator realized on a 300-nm silicon-on-sapphire (SOS) substrate. SOH modulators combine silicon slot waveguides with highly-efficient EO organic molecules, resulting in an efficient low-cost modulator [1]. A racetrack design helps to minimize the bending losses of the optical waveguide, enabling high Q-factors. The modulator should be carefully designed such that the optical waveguides do not contain resistive slabs that would limit high frequency operation. Instead, capacitive coupling sections should be used, as in previous designs of traveling wave modulators [2]. Additionally, the metal electrodes should be designed to allow proper guiding of the 300 GHz RF signal into the modulating section.

The goal of the thesis is to design and simulate the performance of a slot-waveguide-based racetrack modulator on an SOS substrate. The key design parameters should be identified and adapted for optimum performance. The selected design(s) should then be used to generate a layout file for fabrication.

Tasks:

- Design and simulation (using Lumerical) of optical components of the racetrack modulator
- Design and simulation (using CST Studio) of microwave electrodes of the racetrack modulator
- Design of the chip layout (GDS file) for fabrication
- Characterization of the fabricated structures



Interested? Please contact:

Hend Kholeif, M.Sc.
hend.kholeif@kit.edu
Tel. 0721 608-42480

Dr. Artem Kuzmin
artem.kuzmin@kit.edu
Tel. 0721 608-42496

Prof. Dr. Christian Koos
christian.koos@kit.edu
Tel. 0721 608-42491

[1] C. Kieninger *et al., Optica* 5 (6) 739–748 (2018).
[2] Ummethala, *et al*., Optica 8, 511-519 (2021)