BACHELOR THESIS / STUDY THESIS

Investigation and Optimization of Electrodes in Silicon-Organic Hybrid Mach-Zehnder Modulators

Photonics	
Type of work: - Theoretical investigation on characteristics of travelling wave electrodes - Creating calculation scripts in MATLAB - 3D Simulation of travelling wave electrodes in Comsol	**Requirements:** - Knowledge of transmission line theory - Basics in photonics and semiconductor physics - Independent way of working

Background:

Optical communication provides high bandwidths to deal with today's demand of increasing data rates. It is still part of the research to improve the usage of these entire bandwidths. One limiting factor is the modulation of light with Mach-Zehnder modulators (MZM), which are not able to cover the provided frequency ranges. In a silicon-organic hybrid MZM based on the Pockels effect using polymers the light is modulated by applying a radio frequency signal on travelling wave electrodes. Usual bandwidths of this kind of MZM are valued up to 100 GHz. Designing an MZM mostly leads to a trade-off between modulation intensity of the light and maximum electrical bandwidth of the electrodes, while the size of the modulator has to be considered.

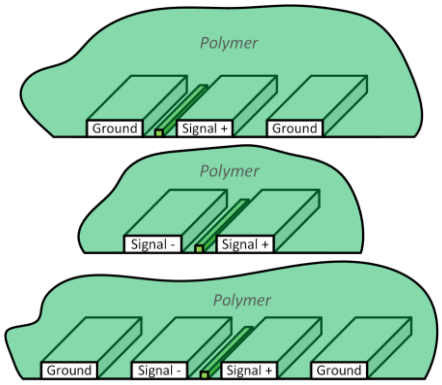

Figure 1: Overview of possible electrode topologies in simplified MZMs

Task:

The main part of this thesis is to investigate different topologies of travelling wave electrodes. The coplanar waveguide (CPW) is commonly used, but the coplanar strip line (CPS) could improve bandwidth and modulation intensity keeping the length of the MZM fixed. The design and calculation of new travelling wave electrode topologies shall take place in MATLAB. The results shall then be verified by 3D simulations in Comsol. In the end, the results shall be transferred to plasmonic modulators and thus be optimized.

The thesis may be prepared in English or German.

Contacts:

Raik Elster	raik.elster@int.uni-stuttgart.de 0711-685-67919	Room 2.409, ETI II
Niklas Hoppe	niklas.hoppe@ int.uni-stuttgart.de 0711-685-67918	Room 2.406, ETI II