

## Aufgabe der Abschlussarbeit im ISE Masterstudiengang

**für:** Frau Bo Zhou

**gestellt von:** Prof. Dr.-Ing. Klaus Solbach  
Fakultät für Ingenieurwissenschaft - Hochfrequenztechnik

**Thema:** **Switchable Array Antennas for 24 GHz Radar Applications**

Description:

There is an increasing demand for radar systems resolving not only the speed and distance of objects but also their angular position in many automotive or security applications. The project HD-Radar, which is publicly founded and supported by the VDI/VDE-IT Innovation + Technik GmbH on behalf of BMBF, addresses these demands. In this project IMST GmbH and its partner are developing a demonstrator for compact high resolution radar system for stationary and mobile applications based on switched multi-antenna system. In order to achieve a competitive commercial radar system low hardware costs, small size, flexible and adaptable detection characteristics and nevertheless high performance are required. One innovative way to meet these requirements is to use switchable array antenna. Switching means here the switching between different beams. This switching is the key technological challenge of the project and can be performed at different levels and with different methods. Generally the problem can be divided into two separate fields. Antenna front-end, which is the passive part of the system and the active RF front-end, which includes the active components required for switching or further processing of the radar signal. Later on the integration of these two parts in one system is also of great importance.

Thesis Task:

The object of this work is to first analyze the system requirements and their effects on the antenna- and RF-frontend. After this first analysis, the work will divide in two parts. The first part is the investigation on different switching technologies. Here it is important to compare the "off-the-shelf" available switching components and choose one technology for further implementation in the RF front-end for this specific radar application. At this point it is important to take system requirements into account. After this step, different switching configurations need to be evaluated. One configuration will be selected to be tested with the chosen RF-switch. The second part of the work contains the investigation on different antenna characteristics suitable for 24 GHz radar application. Here different antenna diagrams should be suggested and the possible application scenarios for each diagram are to be discussed. Later on one antenna diagram / scenario will be preferred and will be synthesized. The array antenna concept and architecture leading to the favorite antenna diagram will be designed. This antenna concept will be simulated using EM modeling software (Empire) and optimized for the integration with the chosen switching concept. The summary of the work to be done can be listed as the following:

- Research on the commercially available switching components for 24 GHz
- Design and measurements of one of the switching circuits
- Design and optimization of one antenna concept for 24 GHZ radar application using EM software
- Final design of the RF front-end including antenna and switching circuit integrated

At the end of the work, a final presentation has to be given in the HFT department.