UNIVERSITÄT DUISBURG ESSEN

Fachgebiet Hochfrequenztechnik

H F T

Fachbereich Ingenieurwissenschaften
Abteilung Elektrotechnik und Informationstechnik

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Aufgabe der Abschlussarbeit im ISE Bachelorstudiengang

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Thema: **Doppler Simulator for 10 GHz Doppler Radar**

Aufgabenstellung:

Our Doppler Radar project aims to realize a demonstrator radar system that allows hearing and the visualization of Doppler frequencies from moving targets and the measurement of velocity. The testing and verification of system components requires the presence of continuous signals that can be processed, rather than a real-world scenario that only provides time-variable signals. Such stationary Doppler shifted radar signals can be created by a so-called Doppler simulator which uses electronic circuits to shift the frequency of a received signal and retransmits the signal after amplification. On the other hand, a Doppler simulator can be used to demonstrate electronic counter measures used in military systems to deny the measurement of the velocity by a hostile radar system.
A simple concept for the realization of a Doppler simulator uses a phase shifter which is fed by the transmitted Radar signal and which phase-modulates the signal to create a frequency shift and which re-transmits the signal back to the Radar receiver. In an earlier Master Thesis, a suitable phase shifter circuit has been realized which can act as the key component in a simulator circuit. The simulator circuit to be developed for use with our 10 GHz Radar demonstrator requires a receiving and transmitting antenna and an amplifier circuit to boost the phase shifted signal before re-transmission to the Radar.
The task in this project is to design, build and test/evaluate a complete Doppler simulator which employs the available voltage controlled phase shifter circuit, two antennas, amplifier circuit and voltage controlled attenuator for 10 GHz. The task incorporates several steps:

- Assess the creation of a Doppler frequency by an ideal linear phase modulation and derive the required phase ramp for the simulation of velocities in the range of 1 to 100 km/h.
- Measure the insertion phase and amplitude variation of the phase shifter circuit as a function of the control voltage.
- Create an electronic circuit which can generate a ramp voltage to control the phase shifter such that the phase variation ramp is approximately linear.
- Create an electronic circuit which can generate a ramp voltage to control the voltage controlled attenuator such that the amplitude variation of the phase shifter can be compensated.
- Assemble the complete simulator circuit and verify its performance together with the Radar demonstrator

At the end of the work, a public presentation of results is to be given.