

PhD Thesis

Topic: Force and Torque Measurement based on Millimeter-Wave Metamaterials

The goal of this thesis is to conceptualize a novel force or torque sensor concept based on millimeter-wave metamaterials. Thereby, also all accompanying sensor effects, which must be considered in a sensor system suitable for harsh environment, are to be illuminated.

In corporation with Infineon Technologies Austria AG



Topic description: Torque is a fundamental physical quantity in any powertrain or power-transmitting component. However, due to the high demands in these applications, there is still a lack of available sensor technology. While state-of-the-art torque sensors are based on strain-gauges, SAW elements or magnetoelastic elements, we work on a fundamentally new approach based on metamaterials. The idea is to tailor the metamaterial properties for specific sensor effects, which in our case then serve to measure force, torque, temperature and other measurands relevant for powertrain applications. Since metamaterials constitute a young and interdisciplinary field of research, this topic offers the opportunity to work on fundamental research questions as well as on application-oriented research.

Objectives:

- Develop a metamaterial-based force/torque measurement concept
- Develop a read-out concept based on millimeter wave chip technology
- Study of effective metamaterial parameters (e.g. artificial birefringence, etc.)
- Research on tunable metamaterials

The work tools comprise Infineon's newest millimeter-wave chip technology, millimeter-wave HF laboratory equipment for frequencies up to 220 GHz, as well as cutting-edge assembly and manufacturing technology such as sub-micrometer 3D printing, inkjet printing and micro assembling for prototyping.

Requirements:

Master in Physics / Material Sciences /Electrical Engineering / Biomedical Engineering and similar

Organizational Matters:

- Duration: 3 years
- Employment: Fulltime contract as university project assistant @ TU Graz
- Supervisor TU Graz: Alexander Bergmann
Phone: +43 316 873 – 30570
Mail: alexander.bergmann@tugraz.at
- Key contact Infineon: Christof Michenthaler
Mail: Christof.Michenthaler@infineon.com