Research and Simulations in Phaseless Spherical Near-Field Measurements

HiWi

Motivation:

Spherical Near-Field Measurement Chamber of the IHF

Antennas are essential to every high-frequency wireless system, be it satellite, mobile communications or radar sensors. Exact knowledge about the antenna far-field radiation characteristic (3D/2D), i.e., radiated power in each direction, is essential for the functionality and development of any of these systems.

Multiple methods can be used for antenna measurements and split into the operating areas around the antenna: far-field (FF) and near-field (NF). One of the most accurate characterization methods is based on spherical near-field (SNF) antenna measurements. As the name indicates, a virtual sphere is defined around the antenna under test (AUT), where measurements are performed. Moreover, they should satisfy a specific sampling criterion and can be in the NF of the AUT. Since the FF is of interest, a transformation is applied to extract the FF from the NF measurements.

Complex data, i.e., phase and amplitude of the measurements, is necessary to apply the spherical near-field to far-field (SNF-FF) transformation. Nevertheless, collecting the phase compared to the amplitude requires more expensive equipment (VNA vs. power meter). Furthermore, measuring a reliable phase at high frequencies starts to be challenging and, in some cases, e.g., integrated systems such as mobile phones, a reference phase is not even available. For these reasons, there is a high interest in phaseless SNF measurements in which the phase can be reconstructed from the amplitude measurements for the transformation.

A well-known method from the literature is to measure the near-field on two spheres around the AUT with different radii. This adds more information to the equation system and facilitates the recovery of the phase. In a similar way and currently investigated at the institute, several measurements can be performed with different *masks* intending to diversify the equation system and enhance the phaseless reconstruction.

Tasks:

- Appropriation of theoretical knowledge and application to simulated data of the SNF-FF transformation and phase retrieval algorithms.
- Intensive usage of MATLAB since the SNF-FF transformation and phase retrieval algorithms are already implemented in MATLAB.
- Research and elaboration of new concepts to improve the phaseless reconstruction.

Adrien Guth, M.Sc.

2nd Floor, Room No. 526
Telephone: +49 241 80-27943
guth@ihf.rwth-aachen.de

Institute of High Frequency Technology
RWTH Aachen University
Melatener Straße 25 | 52074 Aachen
GERMANY
www.ihf.rwth-aachen.de
Telephone: +49 241 80-27932
Fax: +49 241 80-22641