Improving the speed of cylindrical time-domain nearfield antenna measurement systems using compressive sensing

Antenna measurement is crucial to validate the functionality of the antenna. However, the measurement setup can be very expensive, and the measurement procedure could be very lengthy. The measurement constrains as well as cost, can manifest themselves when the Antenna Under Test (AUT) is electrically large. This is because, the far-field region of the antenna could be relatively far from the radiating element, therefore, to capture the far-field (FF) radiation pattern a very big anechoic chamber would be required. One way to reduce the cost is to perform Near-Field/Far-Field (NF/FF) transformation.

In NF/FF transformation, the near-field (NF) of the antenna is measured and Fourier Transform (FT) is applied to obtain the FF pattern. However, using this method will introduce constrains and disadvantages. The main two disadvantages are: 1) Capturing the NF data is time consuming, 2) Relatively complex post processing is required. One of the factors which results in a lengthy measurement, is using spherical coordinate which covers the whole sphere around the antenna. To reduce the measurement time, sparse sampling in spatial domain is exploited. Instead of having equidistant sampling grids, the NF is sampled sparsely.

Moreover, for some types of antenna, the measurement might be done even faster and with acceptable accuracy if other coordinate systems such as cylindrical and planar are used for sampling in the angular domain.

Therefore, in this project it is intended to investigate the possibility of using a mixture of cylindrical coordinate and sparse sampling (Compressive Sensing (CS)), to verify if some advantages over the existing methods could be obtained.

Based on the abovementioned, the main research questions could be formulated as:

1. How CS in spatial domain can be advantageous using cylindrical coordinate?

2. Will the proposed method overcome some of the measurement challenges in NF/FF transformation?

Lastly, the objective of this master thesis is to validate the idea and answering the research questions using theoretical and simulated results.

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-Please provide your CV and transcript of TU Ilmenau.