3rd URSI AT-AP-RASC, Gran Canaria, 29 May – 3 June 2022

Optimal Bi-Polar Scanning for Antenna Near-Field Mapping

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Short-range wireless systems use antennas designed to meet demanding requirements in their near-field (NF) region, where the data transfer occurs. Accordingly, useful techniques for the NF characterization of the antenna under test (AUT) become very important and, among them, scanning techniques using measured data on conventional surfaces play a significant role.

An optimal bi-polar scanning on a planar surface in the radiative NF region of AUT is here considered for the NF characterization. This unconventional measurement scanning was first proposed in [1, 2] to preserve the advantages of the plane-polar scanning with respect to the plane-rectangular one by using a more simple, compact, and cheaper measurement system adopting two rotating movements, i.e., the AUT rotation and the angular movement of an arm supporting the probe. Since the critical point of the scanning techniques is the acquisition time related to the number of needed NF data, the proposal in [1, 2] has been made "optimal" [3, 4] by adopting the non-redundant sampling representations [5] to fix number and positions of the NF samples to be collected. As a matter of fact, a useful choice of the AUT modeling (f.i., oblate spheroidal [3] and very flexible [4] surfaces for radiating systems having two predominant dimensions) minimizes the volumetric redundancy related to the evaluation of the optimal parameters and the corresponding phase functions to be used, thus reducing the number of measurement points and increasing the time saving.

In this contribution, a disk is considered to model planar AUTs and further optimize the bi-polar scanning techniques [3, 4] for such a kind of sources. The corresponding non-redundant NF data are subsequently used in the optimal sampling interpolation (OSI) algorithm to obtain an accurate NF mapping on the considered observation surface. Note that the OSI scheme includes the Tschebyscheff and Dirichlet sampling functions and only employs the nearest samples to the output point. Numerical tests have been performed to demonstrate the effectiveness of the proposed mapping procedure, whose accuracy has been proved by means of maximum and mean-square reconstruction errors at given output points.

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