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Editorial

Mutual Coupling in Antenna Arrays 2013

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The invention of antenna arrays opened up the door for microwave sensing and communications. Most applications of antenna arrays are in the defense and wireless communications areas. The introduction of multiple-input-multiple-output (MIMO) concept in recent years has opened up further opportunities in that the system performance can be maintained with a smaller number of antennas. The existence of mutual coupling effect, that is, the electromagnetic interaction between antenna elements, appears as an undesirable effect in most of these cases. The transmitted and received signals can be significantly distorted such that the signals no longer depend solely on the antenna elements, but also on the array structure and the surrounding environment. Such distortions result in the reduction of channel capacities in communications applications, as well as poor accuracies in ranging and direction finding. In most applications, the mutual coupling effect is unknown. A major challenge is then to characterize this undesirable effect and to accurately estimate the unknown parameters (range, direction) without *a priori* knowledge of the signal environment.

This special issue, which is the third one in its series, provides an international forum for researchers to disseminate their results and ideas to tackle some of these challenging research problems. Five dedicated papers have contributed to this special issue. These papers concern the mutual coupling and its impacts on MIMO communications, direction finding, and MIMO radar. To help interested readers with a quick reference to the main themes of these papers, we briefly introduce them as follows.

The first paper entitled "*Self-interference cancellation-based mutual-coupling model for full-duplex single-channel MIMO systems*," concerns the mutual coupling problem in MIMO communications. The paper addresses the self-interference and mutual-interference of a full-duplex single-channel MIMO communications system.

In the presence of mutual coupling, the array manifold is perturbed, which results in poor accuracies in direction finding. The paper "*Accurate DOA estimations using microstrip adaptive arrays in the presence of mutual coupling effect*" proposes a method to calibrate the undesirable mutual coupling effect for arrays with non-omni-directional radiating elements. The third paper, entitled "*2-D direction of arrival estimation for cross array in the presence of mutual coupling*," introduces a noniterative algorithm based on the Propagation Method for accurate two-dimensional direction finding problems using a cross array in the presence of mutual coupling. The paper "*AR model-based direction-of-arrival estimation of coherent signals in the presence of unknown mutual coupling*" provides a novel signal processing solution based on a spatial autoregression (AR) model for coherent direction finding of uniform linear arrays.

The fifth paper of this special issue, entitled "*Root-MUSIC based angle estimation for MIMO radar with unknown mutual coupling*," explores the direction finding solutions in MIMO radar. A Root-MUSIC based solution is proposed to estimate the incoming signal direction with unknown mutual coupling.

All papers appearing in this special issue have been subject to a strict peer-reviewing process. They are of high

quality and address the mutual coupling problem from different perspectives. Through this special issue, we have provided a medium of dissemination for valuable ideas and conclusions on mutual coupling research. At the same time, we hope that more research innovations can be stimulated for future advances on this subject.

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