Guidelines for Student Reports

SYNTHESIS OF MAXIMALLY ROBUST ANTENNA ARRAY WITH RESPECT TO MUTUAL COUPLING ERRORS BY MEANS A CONVEX MINIMIZATION - CIRCULAR INTERVALS BASED STRATEGY

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Abstract

An antenna array is a set of two or more radiating elements used to achieve improved radiated pattern features with respect to a single antenna. Antenna array are used in different scenarios since their capacity to increase the overall gain of the whole antenna systems, provide diversity in reception, cancel the interference coming from particular direction and steer the beam electronically without any mechanical movements.
Accordingly, the synthesis of such kind of systems have been widely investigated in order to the determine the values of the amplitude and phases (complex weights) of the control points of the array for obtaining a radiating pattern with required characteristics. However, most of those techniques work under the hypothesis that the antenna array is not affected by the so called mutual coupling (MC) phenomena, i.e., the interaction between the radiating elements when they are fed. As a consequence, the radiated pattern could by different from the (theoretically) designed, with worst performance and it could not satisfy the operating constraints. In this framework, the research activity have been mainly addressed by properly model and analyze the MC but no effort has been made to consider the MC directly in the antenna array synthesis. In order to overcome such a drawback, this project proposes to include the MC in an innovative synthesis tool exploiting a convex minimization of interval functions. More in detail, considering the MC model reported in it is possible to compute an upper and a lower bound of the radiated pattern when MC affected the elements of the array using an arithmetic based on circular intervals. Moreover, when the desired pattern features are expressed as power mask constraints, the determination of the weights of the array such that the upper and the lower bounds of the radiated pattern respect the constraints is a convex problem. As a consequence, effective tools can be used to find the optimum set of array weights, and the whole process will lead to a robust antenna array design that whatever the values of mutual coupling it will be able to satisfy the operating constraints.

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