PhD THESIS ABSTRACT

"CONTRIBUTIONS OF THE STUDY OF ARRAY ANTENNA USING GENETIC ALGORITHMS"

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The PhD thesis presents and analyzes the importance of the application of genetic algorithms for the optimization of different types of antenna arrays. Thus, by applying optimization based on genetic algorithms, different approaches are proposed to improve directivity parameters, such as: reducing the sidelobes level, increasing the gain of an array antenna and obtaining more directive configurations.

Starting from the theoretical notions, the doctoral thesis presents the main geometric configurations of the array antenna, being mentioned in this sense the main problems related to the directivity properties and the constraints of the antenna arrays that have a very large number of radiating elements. An important aspect of the doctoral thesis also consisted in optimization based on genetic algorithms from the point of view of reducing the number of radiating elements starting from a fully populated geometric configuration. In this sense, different thinning techniques of antenna arrays are proposed and the directivity performances obtained after their application are analyzed.

In the framework of the doctoral works, starting from the theoretical notions, the design, simulation and evaluation of waveguide and microstrip antenna configurations were carried out in dedicated software programs. The performances in terms of directivity properties obtained through simulations for these configurations were comparatively analyzed before and after applying the optimization process with genetic algorithms. Based on the activities obtained through simulations for antenna arrays formed by waveguides and microstrip antennas, two antenna arrays were practically realized, one consisting of 4x4 waveguides and one consisting of 4x4 microstrip antennas. For the practically realized arrays, measurements were made and comparative analyzes were made of the results obtained through simulations and those obtained through laboratory measurements, as well as comparative analyzes from the point of view of the directivity properties. Also, starting from the activities obtained through simulations in search of rare configurations, two waveguide and microstrip laboratory platforms were practically realized with part of the passivated elements. This solution was tested by performing a comparative analysis, for the new configurations, of the results obtained through simulations with those obtained through laboratory measurements.

Also in this doctoral work, a case study on signal processing in two-dimensional arrays is presented. For this purpose, an array consisting of 4x4 Archimedean spiral antennas was designed, simulated and evaluated, and the processing methods applied in the case of the two-dimensional

array (the synthetic aperture radar technique and the method that is based on principal component analysis). Taking into account the very large size of the two-dimensional array and of course the constraints related to the very high processing times required in real situations, various techniques have been presented to thin the array while maintaining properties similar to those of a fully populated array.

Finally, the conclusions, personal contributions are presented and also the prospects for further research are mentioned.