Paper ID: 87609
oral
student

IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Interactive Presentations - IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (IP)

Author: Mr. Vítor Lima Aguirra
Univerisity of Brasilia, France

QUASI ANALYTIC METHOD FOR DETERMINING THE RESULTING ELECTRIC FIELDS OF ARBITRARY ANTENNA ARRAYS WITH PARAMETERIZED POSITION, ORIENTATION AND FEEDING

Abstract

Antenna arrays provide for an interesting form of creating telecommunication systems. Different systems can require the development of antennas with specific radiation distribuition diagrams. These distributions can be very difficult to be obtained and can be very costly to a project. Utilizing multiple simple, low cost antennas, it is possible to replicate the desired radiation distribution varying the position, orientation and current of each antenna while maintaining low cost to the system. These antennas thus compose an array of antennas.

However, it may be difficult to determine the best parameters of the antennas to achieve the desired result. The optimization of arrays can be a very costly process demanding a lot of time and computational power, and comercial softwares currently focus on designing and optimizing regular arrays for the lower number of variations to be simulated numerically, while a non regular array could possibly provide a better system.

An algorithm for determining the resulting electric fields of arbitrary antenna arrays is proposed. Utilizing previously simulated electric fields of each different antenna element and supposing that each antenna is positioned in the far fields region of its neighbooring antennas, the electric fields of an array with multiple antennas with varied position, orientation and current feed can be accurately, reliably and rapidly calculated.

The proposed algorithm has been implemented in programming languages Octave and Python, providing a simple user interface for importing the antennas and creating and modifying the arrays. For validation of the algorithm, a simple array composed of 5 copies of a Yagi-Uda antenna with 4 elements was numerically simulated with ANSYS Electronics, exporting the resulting electric fields of the array. The electric fields of the Yagi-Uda antenna used was imported into the developed software, and the same array was then modelled in the developed software and the resulting electric fields of the array was determined. The comparison between the two methods, numerical simulation and the proposed quasi-analytic method, shows that the algorithm is capable of replicating the electric fields of the array produced by the numerical simulation with acceptable quality, while being on the order of hundreds to thousands of times faster than the numerical simulation.

Because of the speed of the developed software, this algorithm opens the possibility of optimizing non regular antenna arrays, with a higher number of parameterized variable.