Guidelines for Student Reports

Analysis of the ground plane dimension and shape on the multi-band behavior of a planar monopole coplanar-fed Sierpinski Gasket fractal antenna.

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Abstract

Nowadays, a large number of electronic devices exploits multiple wireless standards. Moreover, the dimensions of such products (e.g., mobile handsets) are becoming smaller and smaller following the users needs and thanks to the progress of the modern integrating circuit technology. In this framework, it is usually necessary to integrate the RF-part (i.e., the whole set of wireless interfaces) in only one antenna.

Such a requirement becomes even more challenging when also a high degree of miniaturization is required. It has been demonstrated that fractal shapes are suitable solutions for both miniaturization and multi-band issues. These results are enabled by two important properties of fractal geometries: the space-filling capability and the self-similarity. The former refers to the ability of fractal curves to be very long occupying a compact physical space. The other indicates that small regions of the geometry are copies of the whole structure, but on a reduced scale, with an expected similar electromagnetic behavior at different frequencies. Moreover, it has been found that by perturbing a reference fractal shape (i.e., introducing some additional degrees of freedom), it is possible to tune the locations of non-harmonic resonance frequencies. The use of a Particle Swarm Optimizer (PSO) algorithm has been validated as an efficient (and clever) way to tune the antenna resonances by modifying its geometrical descriptors.

The project aim is to analyze the impact of the ground plane dimension and shape on the impedance matching characteristics of a coplanar-fed Sierpinski Gasket fractal monopole antenna. The main goal of the activity is to clarify if a link exists between the multi-band behavior of this kind of antennas and the ground plane geometry, investigating what happens when trying to modify the ground plane shape and dimensions of an already optimized geometry, both on the simulated and on the measured models. Moreover, the already-developed synthesis tool (which is based on a PSO optimizer and on FEKO e.m. simulator) will be modified in order to introduce variations on the ground plane shape, in order to see if the multi-band behavior of such antennas can be improved.

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