Analysis of the impact of the vertex-to-edge distance on the resonant behavior of multi-band coplanar-fed Sierpinski Gasket fractal antennas

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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 on radiation performances and impedance matching when modifying the distance between each vertex and the triangles edges of a coplanar-fed Sierpinski Gasket antenna (single and double fractal iteration). Moreover, the activity will introduce this parameter as part of the antenna optimized geometrical descriptors. The goal is to obtain two multi-band antennas, that can be used to accommodate the following wireless communications standards:

- 1 iteration model: LTE 2600 MHz, Wi-Max 3500 MHz
- 2 iteration model: UMTS 2100 MHz, LTE 2600 MHZ, Wi-Max 3500 MHz

Reference Bibliography: Evolutionary Optimization [13]-[53]; Evolutionary Optimization and Fractal Antennas [1]-[12].


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