Multifrequency Properties of Monopole Antennas using Multilevel Ground Planes inspired on the Sierpinski Fractal Shape

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Some advanced antenna geometries can be used to design multiband and miniature antennas, such as those structures described in (Multilevel Antennae, Invention Patent WO0122528) and in (Space-filling Miniature Antennas, Invention Patent WO0154225). However, much attention and engineering efforts are devoted to the radiating element itself, rather than to the ground plane. Depending on the feeding scheme used for the antenna, the ground plane can become a useful contributor in the radiating process. Multilevel structures can be used to design a wide range of antennas and other elements with interesting properties. Multiband monopoles are described in (J.Soler, J.Romeu, C.Puente, "Mod-p Sierpinski Fractal Multiband Antenna", AP2000 Millennium Conference on Antennas and Propagation, Davos, 9-14 April 2000), small and high directivity antenna elements in (J.Anguera, C.Puente, C.Borja, R.Montero, J.Soler, "Small and High Directivity Bowtie Patch Antenna based on the Sierpinski Fractal", Microwave and Optical Technology Letters, vol.31, nº3, pp.239-241, November 2001) and frequency selective surfaces in (J.Romeu, Y.Rahmat-Samii, Fractal FSS: A Novel Multiband Frequency Selective Surface, IEEE Transactions on Antenna and Propagation, vol.48, no.7, pp.1097-1105, July 2000) to name a few.

In addition, these complex structures can improve the radiation performance of an antenna system when used as elements in the ground plane (Multilevel and Space-Filling Ground-Planes for Miniature and Multiband Antennas, Invention Patent PCT/EP01/10589) as it is depicted in Fig.1. The multifrequency properties of these novel antenna solutions with multilevel-shaped ground planes are analyzed and the main results and advantages are discussed.

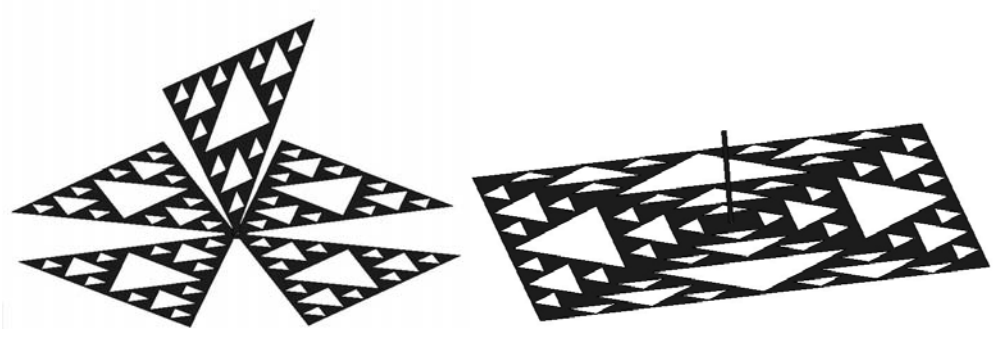

Fig 1 Mod-2 Sierpinski monopole using a multilevel-shaped ground plane with four mod-2 Sierpinski elements, on the left, and a straight monopole above a multilevel-shaped ground plane derived from four mod-2 Sierpinski gaskets, on the right.