Metamaterials and Antennas Leverage Fractal Advantage

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When Marconi invented what are now dubbed 'metamaterials' in 1919, he could not have known that it would take 90 years or more for this engineering field to take off. While metamaterials boast promises of new approaches to sensors, and optics, it is the addition of the exotic geometry of fractals that has brought them to the next level with a hybrid called 'fractal metamaterials'.

At the heart of metamaterials lie tiny electrical circuits called 'resonators'. Closely packed and nearly touching, these resonators, usually simple wire-like shapes, can be used to alter and guide waves in a very different way from a conventional lens or a mirror. "Marconi and his colleague understood this and fashioned radio mirrors using metamaterials, and then were ignored for a lifetime", notes Fractal Antenna Systems CEO Nathan Cohen, who invented fractal metamaterials under the firm's patents and IP. "Oddly, most metamaterial work today uses designs from radio inventor Heinrich Hertz's first resonators from 125 years ago, pre-dating even Marconi. So there was some catching up to do. We saw the opportunity for a huge leap in improvement-- with fractals as the resonators," Cohen added.

Fractal geometry proves a synergistic, innovative piece of the metamaterial puzzle. These intricate designs are built from scaled replications of a simple shape and have unique electromagnetic properties, as well as other beneficial properties which are traditionally produced by expensive and unreliable add-on components to conventional antennas. When used as resonators in metamaterials, fractals produce multiband and wide bandwidth and more versatile performance, a concept previously thought impossible. For example, fractal metamaterials gave rise to the first wideband and hi fidelity invisibility cloak, despite famous statements that it couldn't be done. In another example, the classic monopole antenna--another Marconi invention-- has dramatically benefited from better gain and very wide bandwidth with the fractal metamaterials.

In many cases fractal metamaterials enable applications previously unrealized, such as tiny recessed antennas next to metal. Even conventional antenna designs can be retrofit to give them expanded performance abilities that used to require many additional antennas. "Cost savings can be significant by eliminating unreliable loading components and matching, antenna assemblies and external antennas," says Cohen. "We offer fractal metamaterials right now in many of our products and designs, and the list grows daily. Applications included but aren't limited to, RFID, DAS, cell, smart sensors, broadcast, public safety, Wi-Fi, and many others. Fractals have made a quiet revolution in a very old field, leapfrogging it into the 21st century."

ABOUT FRACTAL ANTENNA SYSTEMS, INC.

Fractal Antenna Systems, Inc. (http://www.fractenna.com) supplies products for the world's most demanding wireless, and electromagnetic applications. Backed by over three dozen U.S., and international patents, plus dozens of patents pending, Fractal Antenna Systems is the recognized pioneer and leader in fractal technology, with extensive research, field experience, and development over 18 years in business. The company is a privately held and headquartered in Waltham, Massachusetts, USA.

SOURCE: Fractal Antenna Systems, Inc. , jwinter@fractenna.com