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Fractalcoms* Exploring the limits of Fractal Electrodynamics for the future telecommunication technologies

The aim of this FET** project is basic research on fractal electrodynamics in order to explore the performance limits (both fundamental and technological) of highly innovative fractal shaped miniature devices for future wireless telecommunications systems.

Classical antennas are highly sensitive to size in terms of the wavelength. The possibility of creating fractal multiband antennas, using the self-similarity property of fractal shapes, has successfully been demonstrated.

In addition, classical antennas cannot be made arbitrarily small. The fractal shapes may lead to a significant size reduction: the fractal dimension. In practice, a fractal shaped device can be made arbitrarily long until the technological limit is reached. Therefore, these new devices can be designed to accomplish the fundamental limit, which establishes the smallest size of a device for a given operating bandwidth, much better than Euclidean ones.

An important research has to be done relating the loss of efficiency, due to the concentration of currents and electromagnetic fields into very small regions, with the consequent gain reduction of these antennae, or increasing the insertion losses for microwave filters and resonators. Many prototypes have to be designed and checked to find the best topologies and parameters.

GiD is used in this project to create a powerful tool to generate the complex geometry and mesh of thin wire, planar-strip, fractal antennae and planar-surface antennae. This complexity does not only reside in the recursive creation of the fractal itself, but also in the definition of the width of the planar strip. Once the lines that define the fractal geometry are created, then a segment of the desired strip-width is extruded (using the "Sweep" copy option) along the whole fractal. With a high level of recursion, more than a thousand surfaces, together with a big width for the strip, this will result in intersections and collapsing of surfaces.

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** Future & Emerging Technologies is the IST programme nursery of novel and emerging scientific ideas.
http://www.tsc.upc.es/fractalcoms/

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Food Technologies Simulation, optimisation and control of food processing

Competitiveness in the food sector is driven by the need to offer high quality products with adequate shelf lives. Therefore, many research efforts are devoted to develop new preservation techniques and to improve the traditional ones to ensure a longer shelf life of food products. In this regard, the use of adequate modelling, simulation, optimisation and control tools is crucial. Advanced computer aided techniques can be effectively used to model and simulate physical treatments and their biological effect on foods (death of microorganisms...), select the most suitable operating conditions to guarantee a safe product with the maximum possible nutritional content, control that the plant operates as closely as possible to those optimal operating conditions.

A new software package is being developed for the simulation, optimisation and control, of the most relevant food preservation techniques. This novel tool will provide an easy to use environment, based on GiD, with suitable numerical methods, which will allow food industries to improve their specific processes in an effective way.

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