PA-CONECTA: Software for the analysis of a multi-cell coverage level

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This paper presents the PA-CONECTA software, which has been developed in order to calculate the electromagnetic field levels over an arbitrary terrain. The program has been developed under the Matlab programming language. The kernel of the software implements the PO-ML-BSP algorithm. It is based on: the Physical Optics (PO) approximation (Arias, Rubiños and Pino, R.R.D. in Magnetics, vol.1, 2000 pp.43-63. ISBN: 81-86846-89-1) in order to determine the induced currents over the terrain, the Binary Space Partitioning (BSP) technique to determine the visible and hidden parts, and a Multilevel (ML) scheme in order to reduce the computational cost.

The software has been programmed with a modular structure. A geometric module is used in order to define the terrain to be analyzed. Two different models can be considered. The first one is deterministic and consists of two files containing points and triangles that model the terrain. The files have been obtained from digitalized terrain maps. The second one is a random scenario generated by the application. It takes into account some user defined parameters of the terrain (maximum height, size of the scenario…).

Once the terrain has been selected, a new module is used in order to set the position of the base stations considered in the scenario. In this module, the user specifies the number of antennas for each station. Each antenna has its own radioelectric parameters (radiation pattern, input power …). Once the stations are defined, the program presents a figure where the coordinates associated with the antennas are presented.

The next step consists of the analysis of the coverage level by means of PO-ML-BSP module. This module allows the user to take into account reflections produced across the terrain. Multiple reflections have a high computational cost in a PO-BSP traditional scheme. This can be reduced with the PO-ML-BSP technique that splits the scenario into different voxels, which are groups of triangles contained in a geometric domain (usually cubes). A voxel of superior level is generated by joining adjacent voxels. This multilevel scheme computes the reflections voxel by voxel instead of facet by facet with significant computational cost reduction.

The module of representation allows the user to depict the terrain (Fig. 1a) and the computed fields over the selected observation points as presented in Fig. 1.b.

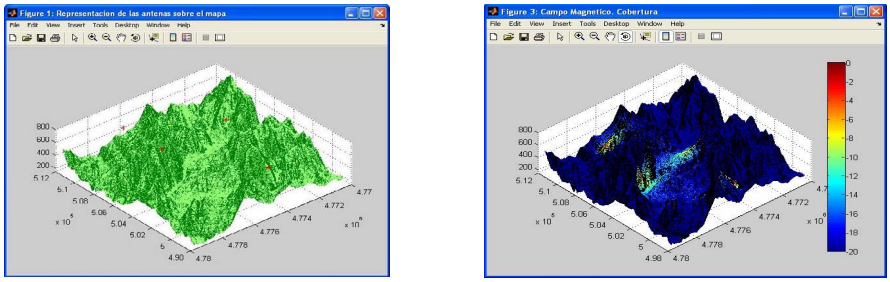

Figure 1- (a) Example of terrain with four base stations
(b) Coverage colour plot