A Convex-Space Discretization of a Building, Designed for Indoor Resource Optimisation using Ray-Tracing Techniques

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Abstract—The purpose of this work is to provide a fast multipoint ray-tracing algorithm when the location of many transmitters is not fixed. When optimising the location of multiple transmitters numerically using an optimization algorithm the visibility algorithm for reflective and diffractive surfaces is normally computed each time the transmitter is moved. However when splitting the building into a set of convex spaces, the visibility algorithm does not need to be changed at any iteration of the optimisation process, since the convex spaces inherently provide the visibility algorithm themselves.

II. IMPLEMENTATION

The method was implemented in software and tested on a three storey building where the boundaries of the convex spaces were confined to exist in the x, y or z planes. The method was also tested on the fictitious building described in Fig. 1, to ensure that the diffraction points and reflection points where fully accounted for. The electromagnetic wave scattering algorithm applied to the ray-tracing was tested in a real building using blueprints to design the building and using a network analyser and omni-directional antenna to calculate the field strength.

Fig. 1. Electric field at 9600 points with 3 reflections and 1 diffraction

REFERENCES