A Comparison of Antenna Placement Algorithms

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Abstract

Co-location of multiple antenna systems on a single fixed or mobile platform can be challenging due to a variety of factors, such as mutual coupling, individual antenna constraints, multipath, obstructions, and parasitic effects due to the platform. The situation frequently arises where a new communication capability, and hence antenna system, is needed on an existing platform. The problem of placing new antennas requires a long, manual effort in order to complete an antenna placement study. Moreover, the search space becomes exponentially large with regard to the number of antennas to be placed. An automated procedure for determining such placements would not only save time, but would be able to optimize the performance of all co-located antenna systems.

Applying an evolutionary algorithm (EA) to this problem could greatly improve this process by automatically determining acceptable antenna placements. Evolutionary algorithms encompass a variety of computer search technologies, with the Genetic Algorithm (GA) being the most well-known [1]. Also, EAs have proven very capable in discovering high performance antenna designs [2].

In this paper we provide a formulation of the antenna placement problem, and examine a set of stochastic algorithms to determine their effectiveness at finding optimal placements for multiple antennas on a platform. To our knowledge, this is the first study to investigate optimizing multiple antenna placement on a single platform using multiple stochastic algorithms. Among the evaluated algorithms, simulated annealing and evolutionary strategy were found to be most effective in finding optimal placements.

References

[1] Holland, John H. "Adaptation in natural and artificial systems: an introductory analysis with applications to biology, control, and artific." (1992): 211.

[2] Hornby, Gregory, J. Lohn, and D. Linden. "Computer-automated evolution of an x-band antenna for nasa's space technology 5 mission." Evolutionary computation 19.1 (2011): 1-23.