Coverage Optimization Using Lattice Flower Constellations

Doctoral Dissertation Defense

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Abstract

Recently developed satellite systems require a group of satellites acting in concert with one another to meet mission objectives, as in formation flying or constellations. Optimal constellation design is a challenging problem because of the high dimensionality of the problem. Using elliptical orbits, the Lattice Flower Constellations theory requires nine parameters of which six are integers while using circular orbits the parameters become five of which three are integers. A general optimization technique implies finding the optimal values of these parameters. This dissertation introduces a general process to perform constellation optimization for any specific optimality definition, that is, for any specific space mission. To demonstrate the feasibility and the effectiveness of the proposed approach this optimization tool is applied to three distinct types of space missions: a) global radio occultation, b) interferometric imaging, and c) constrained communication missions. The results obtained validate the proposed methodology.

Sanghyun Lee is a PHD candidate in the Aerospace Engineering Department working under the supervision of Professor Daniele Mortari. His research interests are in the areas of orbital mechanics and space missions with emphasis on constellation design. He is currently a major in the Republic of Korea Air Force and will be employed as a faculty of aerospace engineering at the Air Force Academy of the Republic of Korea.