Geometry of GPS Mathematics

Peiliang Xu[1]

[1] DPRI, Kyoto University

To study the statistical and probabilistic aspects of GPS integer ambiguities for quality control of precise positioning products, we have first to investigate the geometry of integer GPS models, which turns out to be similar to the geometry of numbers in mathematics and as part of communication theory, for example. In this talk, we will first show that the geometry is uniquely defined by the Voronoi cell with a unity volume. We will then propose methods to construct the Voronoi cell of a lattice. Numerical examples will be shown how a Voronoi cell looks like in the two-dimensional case. Finally, we will further prove that the upper probabilistic bound proposed by Shannon in 1958 and widely accepted as best is not necessarily the best possible.