

IAF ASTRODYNAMICS SYMPOSIUM (C1)
Orbital Dynamics (2) (2)

Author: Prof. Mikhail Ovchinnikov
Keldysh Institute of Applied Mathematics, RAS, Russian Federation

Mr. Sergey Shestakov
Keldysh Institute of Applied Mathematics of RAS, Russian Federation
Mr. Yaroslav Mashtakov
Keldysh Institute of Applied Mathematics of RAS, Russian Federation

ANALYTICAL APPROACH TO CONSTRUCTION A REFERENCE MOTION FOR TETRAHEDRAL
SATELLITE FORMATION**Abstract**

In many modern scientific space research projects the measurements should be performed simultaneously in different points of space or in the same point but with a small time delay. The one particular interesting for us scientific research is the one exploring the Earth's magnetic field. To provide accurate results in this case it is necessary to perform measurements not just in several different points of space: the satellites should form a 3-dimensional structure in space. Therefore, the minimal amount of satellites needed to perform such a measurement is four. Moreover, they should form the particular tetrahedral structure, which should not be degenerative and must remain as constant as possible.

The goal of the present paper is to find reference motion of four satellites that is suitable for this description. We use assumptions that the satellites move along near circular orbits and major semi-axes of each satellite orbit are equal to prevent relative drift. In the paper we define analytically such initial conditions and therefore such reference motion of satellites that the tetrahedron they form preserves its volume and shape in a linear model of motion. We also define an index describing the distortion of the tetrahedron, and show that the optimal solution approximately keeps the geometry fixed. General expressions for the initial parameters are obtained, and for some special cases the solution families are found. Numerical study that includes J_2 perturbation is conducted for different types of orbits such as LEO, GEO and elliptical ones.