Optimal Maneuver Schedule for Constellation Keeping and Positioning

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The problem of optimal station keeping and positioning for constellation

is considered. We propose the method of maneuvre schedule calculation for maintaining of mutual disposition of satellites during long time with needed accuracy. The method utilize the iterative procedure allowing to apply simple algorithms to define impulse parameters and ensuring high accuracy in forming the desired orbits. It is possible to calculate maneuvre schedules for both absolute and relative station keeping.

In the first case the motion of each satellite is associated with the stated one. In the second case the motion of constellation is associated with the reference orbit. The elements of the reference orbit

are choosen so that to minimize the function F defined as: $F = \sum dWi/Wi$, where dWi - impulse, Wi - characteristic velocity of the i-th satellite.

The use of this function allows to distribute fuel consumption homogeneously between all satellites. The total energy costs and the required number of impulses of the relative station keeping are considerably lower than those of the absolute keeping.

The general computational scheme allows to optimize the motion of a constellation as a whole also in the case when some satellites perform maneuvres to transfer from one point to other (from injection orbit into final orbit, or from one operative point into another). In this case, numerical-analytical algorithmes for determination parameters of optimal rendezvous are used.

The maneuvre schedule computation doesn't require considerable time expenditures because the satellite motion prediction based on the THEONA

theory ensures both needed accuracies and high rapidity of calculations.