NEAR-EARTH ASTEROIDS ORBITS IMPROVEMENT USING SINGULAR VALUES

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Some results of the singular value analysis of the problem of estimation of initial orbital parameters of NEAs crossing the Earth's sphere of influence during from 1950 to 2050 are presented. Most of these objects are unnumbered and have been observed at a single apparition.The problem of the orbits improvement of objects of such kind is ill-conditioned as a rule. Conditionality of the problem is depends principally on the length of period of observations and their distribution on the orbit, but it depends on other factors: choice of the initial epoch and numerical algorithm of solution. The numerical experiments demonstrated that condition number can be considerably decreased by means of corresponding choice of the initial epoch. In order to not to make worse conditionality of the problem by calculations algorithms based on the orthogonal transformations and stable with respect to errors of the input data are used in improving the initial orbital parameters. The singular value analysis of the equations of conditions has been carried out and a vicinity of the matrix A of the differential coefficients to the singular one has been evaluated for every object. Methods of the stabilization of the solution have been applied for ill-conditioned matrices. The stabilization is carried out by means of the singular value decomposition of the matrix A and by using additional equations on the basis of the first derivatives of the observed coordinates. The estimation of the accuracy of solution of minimal norm of ill-conditioned problem on the example of different samples of observations of NEAs Hathor and Toutatis is given.