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Dynamic Analysis of a Model of the Axial Rotation of the Earth

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On the basis of previously constructed model of uneven inter annual axial rotation of the Earth by using of the methods of celestial mechanics and the amendment method to the perturbations of the zonal tidal potential a refined dynamic model of uneven rotation of the Earth, appropriate to observations and measurements of IERS, has been developed and studied. It more accurately describes the variations of the modulus of the angular velocity at time intervals of inter annual to inter diurnal and contains components with a different set of frequencies (from major lunar-solar frequencies to non-stationary which follow from the structure of the model).
The numerical modeling (interpolation and prediction) and the development of the rotational motion of the Earth's on components in accordance with the constructed model has been given. The main characteristics and examples of the construction of forecasts compared with observations and measurements of the International Earth Rotation Service (IERS) have been studied.
From analysis of the results of numerical simulation it follows that forecasts of additional components that refine the basic model have different reliability and accuracy characteristics depending on the length of the projected interval. The need to consider each of them must be justified and is defined as the required prediction accuracy characteristics and physical statement of the solved problem.
Also based on celestial approach a mathematical model of diurnal tidal uneven rotation of the deformable Earth taking into account the gravitational tidal perturbations of the Moon and the Sun, adequate to astrometric measurements of IERS, has been developed. To improve the accuracy of prediction of the base model it is required to estimate the need to take account of various terms and models to choose their optimal interpolation ranges.
Fulfilled analysis of the dynamic process of the rotational motion of the Earth in the developed mathematical model aimed at identifying the mechanisms determining the formation of the unevenness of the Earth's rotation and affect the geophysical processes of global scale. These mechanisms of interaction between the fine resonance structure of long-period zonal tides (annual, semiannual, monthly, two weeks) with the diurnal and semidiurnal tides generate the various components of the rotation, which can be regarded as one of the main dynamic parameters of the planet.
Celestial-mechanical model of the Earth's rotation irregularity, adequate to observations and measurements and describing the dynamics of change in the modulus of the angular velocity at the qualitative level, can be the basis for the analysis of most from the global natural phenomena (such as general circulation of the atmosphere, changing of the global seismic activity, large-scale motions in the atmosphere and oceans etc.).
As a further development of the constructed model we plan to study sudden unpredictable fluctuations in the planet rotation and their relation to the geophysical processes of global scale, as well as records of irregular fluctuations of stochastic nature in combined spectral-correlation models.