

Dynamics of the planet shells: new problems of the celestial mechanics and applications

Barkin Yu.V.¹

¹*Sternberg astronomical Institute, Moscow*
E-mail:barkin@sai.msu.su

New generalized treatment of the n body problem has been suggested. Every body is the define system of the mutually interacting shells. In general case these shells are non-spherical and non-homogeneous. They also are considered as individual celestial bodies interacting one to another and with external bodies shells. In dependence from the studies the sells are considered as rigid bodies or deformable bodies with define physical properties and structure, are took into account the elastic and inelastic shell interactions, some from shells can be liquid, or gaseous, or empty. The wide class of the problem is concerned of the study of the small relative motions of the shell centers of mass and they slow relative rotational motion for the every body-system together with classical aspects of the problem on the study of the translational- rotational motions of the body-system. In cases of the empty, gaseous and liquid shells the assumption about small displacements of the shell centers of mass and they slow rotation is not necessary. The new treatments of the problem have place practically for all fields of the celestial mechanics (theory of attraction, developments of force functions, equilibrium of the liquid gravitating bodies, n body problem and others) and have very important meaning for geodynamics and planet dynamics of the Solar and Extra-Solar systems. The developments of the force function of the inner variant of two body problem were constructed in coordinates and in Andoyer-Delone variables. The problem about variations of the inner Earth mantle potential due to tidal attraction of the Moon and Sun has been solved. The stationary solutions of the inner variant of the two body problem and their stability were studied (case of the empty cavity and with consideration elastic interactions of the body). Translational oscillations of the spherical rigid core into liquid core have been studied. The small relative oscillation of the two shells of the body (the Earth) in the gravitational field other two point-bodies (the Sun and the Moon) were studied on the basis of the restricted four-body problem. A elastic shell interaction and real properties of the lunar (and solar) orbit were took into account. These and other results about mechanism of the relative displacements of the Earth shells have been used for important applications in the geodynamics and planet dynamics. The observed paleomigration of the Earth pole, the non-tidal deceleration of the Earth diurnal rotation were explained. The migration of the Earth centre of mass in geological time-scale was predicted. The observed long-periodic perturbations in the Earth pole motion were explained by the long-periodic variations in the Earth envelopes position and similar variations of the geopotential were found. The phenomena of the synchronism , cyclicity , inversion of the geophysical and geodynamical processes and phenomenon of the general rhythms of the shell-bodies of the solar system were discovered. The non-tidal acceleration of the Earth rotation, pole motion and secular variations of the coefficients of the zonal harmonic of geopotential were obtained theoretically in good agreement with observation data.