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Minimum altitude variation orbits. Analysis of characteristics and stability.

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The article discusses the regularities of satellite motion in almost circular orbits under the influence of the second zonal harmonic of the geopotential. The aim of the research is to determine the parameters of orbits with a minimum change in radius and to study the properties of these orbits. It is shown that the problem of determining the parameters of orbits with a minimum change in radius is of theoretical and practical interest. These orbits are the closest to Keplerian circular orbits. The practical interest in such orbits is determined by the possibility of using them for scientific research and Earth observation systems. Based on the analysis of the literature, it was concluded that the solution of the problem under consideration is not complete by now: the algorithm for determining the parameters of the orbits are not well founded and unnecessarily complicated; there is no analytical analysis of the stability of the orbits of the minimum change in radius. The efficiency of application of the previously developed theory of describing the motion of satellites in almost circular orbits for determining the parameters of orbits with a minimum change in radius is shown. For this purpose, the solutions of the first approximation of the motion of satellites in almost circular orbits under the influence of the second zonal harmonic of the geopotential have been improved. These solutions make it easy to determine the parameters of the orbits of the minimum change in radius. The averaged equations of the second approximation of the influence of the second zonal harmonic on the satellite motion are constructed and, on their basis, the stability of the orbits with a minimum change in radius is proved. It is shown that the second approximation in small parameters completely describes the main regularities of the long-period satellite motion under the influence of the second zonal harmonic of the geopotential. With the help of numerical studies, the instability of orbits with a minimum change in radius is shown with allowance for the effect of higher order harmonics of the geopotential. Analysis of the area of possible application of orbits with a minimum change in radius showed that such orbits can be of practical importance for very low and ultra low orbits, where the control action on the satellite movement is carried out at least once every two days.

Keywords: *minimum altitude variation orbits, second zonal harmonic of the geopotential, stability of the orbits, regularities of motion.*

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