

The task of studying lunar mascons based on high-resolution orbital photogrammetry

Shpekin M I[®], Usanin V S, Fazletdinova R Yu, Arkhipova A A and Gabdulkhakov A D

Kazan Federal University, Kremlyovskaya Street 18, Kazan, Tatarstan 420008, Russia

© MichaelS1@yandex.ru

As is known, the first measurements of anomalies in the Moon's gravitational field were undertaken in the Soviet Union in 1966 at the Keldysh Institute of Applied Mathematics. Then, the presence of field anomalies was confirmed in the USA by observations of the Lunar Orbiter series satellites. In 2011–2012, a special program was implemented to study the gravitational field and thermal history of the Moon, called GRAIL. Based on its results, a detailed map of mascons was built throughout the entire territory of the Moon. In the GRAIL experiment, a method was used to accurately track the mutual position of two small satellites in a low polar orbit. An alternative approach to explaining the GRAIL results was proposed. In our report, another independent algorithm for solving the problem is considered. It is based on tracking the position of the satellite in lunar orbit by the method of orbital photogrammetry as the satellite passes over the territory of the proposed mascon, followed by an analysis of the behavior of the satellite tied to the lunar coordinate system through the reference craters identified in the images of the camera installed on board. To test the proposed algorithm, the authors used images from the metric camera of the “Apollo-15,-17” spacecraft at the time of the passage of craft over two young impact craters with diameters of 130 and 180 km. The report presents the first results obtained on two orbits, an analysis of our measurements and prospects for applying the proposed algorithm to materials from other lunar missions and other territories.