应用数学讲座

Научный Семинар по Прикладной Математике

Research Seminar on Applied Mathematics

应用数学报告（52）

报告人 / Докладчик / Speaker: **Prof. A.G. Yagola (Lomonosov Moscow State University)**

题目 / Название / Title: **About methods of recovering of the magnetic fields using experimental data**

时间 / Время / Time：**23 Jul. 2022, 14:30-15:00**

地点 / Место / Venue: **Zoom ID: 462 476 1414**
Password: 777777

摘要 / Аннотация / Abstract:

The development of the advanced technology extended our possibilities for acquisition of experimental data. For example, access to information about the magnetic fields of planets became possible due to the emergence and development of interplanetary missions. The data obtained thanks to these missions make it possible to solve inverse problems of reconstructing the distribution map of the magnetization parameters. The study of the magnetic fields of the planets is one of the ways to obtain information about the internal structure of the planet and its evolution. Also since in recent years the acquisition of the full tensor gradient data becomes available retrieval of magnetic parameters using magnetic tensor gradient measurements receives attention. In work [1], the problem of restoring magnetization parameters has been solved. In this problem three scalar functions (components of the magnetization vector) were recovered using data by five scalar functions (independent components of the magnetic tensor). In our work [2] we consider the problem of magnetic susceptibility restoration using magnetic tensor gradient measurements. In this work we have recovered one scalar function (magnetic susceptibility) using data by five scalar functions (components of the magnetic tensor). As we are dealing with the physically overdetermined problem we expect to receive better results than if the problem was just physically determined. In work [3], using approaches from works [1,2], the problem recovery of magnetization in the crust of Mars based on satellite data from the MAVEN

mission (NASA's Mars MAVEN orbiter, 2020) has been solved. This task was physically determined since we have recovered three scalar functions (components of the magnetization vector) by three scalar functions (independent components of the magnetic field). In the work [3] are also discussed possible ways to increase accuracy of restoration of magnetization parameters. Also we have recovered magnetization parameters in the crust of Mercury according to the data from the MESSENGER mission (2014). Using magnetization parameters in the crust of Mercury we solved forward problem and recalculated magnetic field on the spherical surface around Mercury and, applying Gauss-Mie expansion, we have received magnetization parameters of the magnetic masses in the crust of Mercury.

References:

1. Y. Wang, D. Lukyanenko, A. Yagola. Magnetic parameters inversion method with full tensor gradient data, Inverse Problem and Imaging, Vol. 13, No. 4, pp. 745-754, 2019.

2. Y. Wang, I.I. Kolotov, D.V. Lukyanenko, A.G. Yagola, Reconstruction of magnetic susceptibility using full magnetic gradient data, Computational Mathematics and Mathematical Physic, Vol. 60, pp. 1000–1007, 2019.

3. I. Kolotov, D. Lukyanenko, I. Stepanova, Y. Wang, A. Yagola., Recovering the magnetic image of mars from satellite observations, Journal of Imaging, Vol. 7, No. 11, 234, 2021.