



## **Determination of gravitational potential distribution over a geocentric quasi-sphere based on satellite-to-satellite frequency transmitting**

Ziyu Shen (1), Wenbin Shen (2), and Shuangxi Zhang (3)

(1) Hubei University of Science and Technology, Wuhan, China (theorhythm@foxmail.com), (2) Department of Geophysics, School of Geodesy and Geomatics/ Key Laboratory of Geospace Environment and Geodesy of Ministry of Education, Wuhan University, Wuhan, China (wbshen@sgg.whu.edu.cn), (3) State Key Laboratory of Information Engineering in Surveying, Mapping and Remote Sensing, Wuhan University, Wuhan, China

Here we provide a method of determining the Earth's gravitational potential distribution over a geocentric quasi-sphere (QS) that is constructed by a low earth orbit (LEO) satellite, based on frequency signal transmission between the LEO satellite and a cluster of high earth orbit (HEO) satellites. By emitting and receiving frequency signals between the LEO satellite and a HEO satellite, we can determine the gravitational potential at the LEO if the potential of the HEO satellite is given. For a near-polar LEO with height about 350 km above the geoid such as GRACE type satellite, we choose 3 HEO satellites such as geostationary satellites to determine the gravitational potential at the LEO position. Simulation experiments show that the accuracy of the determined gravitational potential distribution over the QS can achieve centimeter level if the accuracy of the given potentials of HEO satellites is about 1 cm level, and optical atomic clocks with instability of  $1 \times 10^{-18}$  are available. Finally, the Earth's external gravity field can be determined based on the potential distribution on the QS. This study is supported by NSFCs (grant Nos. 41804012, 41631072, 41721003, 41429401, 41574007, 41874023, 41804012).