Paper ID: 64084
student

28th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Interactive Presentations - 28th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (IP)

Author: Dr. Zhaokui Wang
Tsinghua University, China

Dr. Dapeng Han
Tsinghua University, China
Mr. Yunhan He
Tsinghua University School of Aerospace, China
Dr. Guangwei Wen
Tsinghua University, China
Prof. Yulin Zhang
Tsinghua University, China

Q-SAT FOR ATMOSPHERE AND GRAVITY FIELD DETECTION: DESIGN, MISSION AND PRELIMINARY RESULTS

Abstract

Q-Sat, a small satellite developed by Distributed and intelligent Space System Lab (DSSL) of Tsinghua University, was launched into orbit on Aug 6, 2020 successfully with the flight of CZ-2D rocket from Jiuquan Satellite Launch Center northwest of China. The mission of Q-Sat is to detect the earth gravity field and the upper atmosphere density. In order to ensure the accuracy of the detection results, the satellite is designed in the shape of a sphere, which is why it is called Q-Sat. The main payload of Q-Sat is a dual-frequency GNSS receiver, which can provide the precise orbit data with the accuracy of 5cm. According to the precise orbit information, the earth gravity field and atmospheric density can be calculated together by the dynamic inversion method. Faculties and students in DSSL participated in all phases of the design, manufacture and test of Q-Sat and its separation system. The design of Q-Sat is presented briefly in this paper. The challenges brought by the spherical structure is discussed, together with the solutions. The satellite works very well on orbit now and carries out on-orbit detection and test as planned. Atmospheric density calculation is carried out based on the telemetry precision orbit data. The preliminary atmospheric model is built and it is verified by orbit forecast. Based on the 6-day actual orbit determination data of Q-Sat, a gravity field model with 25 effective orders was obtained based on the energy conservation method, which proved the validity of the Tsinghua Scientific Satellite observation data. The preliminary results show that the dynamic inversion method is effective and the mission performance is satisfactory.