

MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Microgravity Sciences Onboard the International Space Station and Beyond (6)

Author: Dr. Wenbo Dong

Technology and Engineering Center for Space Utilization, Chinese Academy of Sciences, China

Dr. Zhang Yongkang

Technology and Engineering Center for Space Utilization, Chinese Academy of Sciences, China

A DESIGN OF MICROGRAVITY FREE-FLOATING PLATFORM FOR AUTOMATIC CONTROL
TESTS INSIDE THE SPACE STATION

Abstract

The space station provides excellent opportunities for space utilization of microgravity science and technology. With the help of astronauts and large activity area, we can release an autonomous free-floating object (or called as small satellites or robot assistants) for automatic control test inside the spacecraft. Such experiments are easy to operate, low costing, low requirement of reliability and do not produce space garbage, compared with to launch a real satellite or space robot in space. In ISS, numerous programs such as SPHERES, mini AERCam and PSA have been successfully operated or proposed. We also designed a free-floating platform (robot or satellite) controlled by air thrusters. It comprises of a structure of globe shape, an embedded control system, a measurement system and a propulsion system. The measurement system includes accelerometers and a binocular vision system. The thruster system is made up of an air cylinder, air capacity and 12 air nozzles, which are controlled by electromagnetic valves. The control unit is based on an embedded computer and circuits, sampling sensor signals, computing and driving the thrusters. A prototype has been completed and tested in the air-bearing table, with which we are able to make the control experiment in only 3-deminsional test. The control performance is mainly depended on sensor precision and especially on thruster's character. Until now, it can automatically move along a setting trajectory or stop at any point with accuracy of cm. In the future, we will plan to promote such application cases to operate in Chinese Space Station, for supporting control technology experiment and some education programs, even providing better microgravity conditions for some scientific experiments.