MICROGRAVITY SCIENCES AND PROCESSES (A2)
Facilities and Operations of Microgravity Experiments (5)

Author: Prof. Weijia Ren
Technology and Engineering Center for Space Utilization, Chinese Academy of Sciences, China, renweijia@csu.ac.cn

Dr. Hanxun Zhang
Chinese Academy of Sciences, China, rkzhang@aoe.ac.cn
Dr. Yang Gao
Academy of Opto-Electronics, Chinese Academy of Sciences, China, gaoy@aoe.ac.cn

MICROGRAVITY ACTIVE VIBRATION ISOLATION SYSTEM FOR SPACE SCIENCE IN CHINA

Abstract

Microgravity environment is an important advantage for space science; however, the actual environment is not good enough for some experiments in space station in the presence of several kinds of disturbances such as mechanical vibration and human activity, etc. Active vibration isolation system would provide better microgravity for experiments by actively isolating payload from the space station using electromagnetic actuators. The system consists of a stator and a floater. The stator would be fixed on the space station; the floater would float and only link to the stator by umbilic cable. For high frequency (¿5Hz) disturbance, because the passive isolation characteristic of the cable, disturbance on the floater would be low enough for payload. For low frequency disturbance(0.01 5Hz), active isolation function would be used. The control system includes an acceleration loop and a displacement loop. The acceleration loop senses floater's acceleration by acceleration sensor and imposes counterforce which is produced by electromagnetic actuators on the floater to reduce acceleration to zero. The displacement loop senses floater's location relative to the stator by displacement sensor and imposes counterforce when the floater would contact with the stator. Wireless transmission technology is used in this system to lower the stiffness of the umbilic cable. Scientific data from payload and state data of the floater are transmitted by wireless channels. High voltage power wires are used to supply power to the floater and payload, so the number of power wires is reduced and the stiffness of the umbilic cable is minimized. The system has been tested on a 3 degree-of-freedom airbed flatform which can counteract the gravity and supply an approximate microgravity environment in horizon plane. Both stator and floater float on the flatform. Lower frequency mechanical drivers and high frequency electromagnetic drivers are used to impose disturbance on the stator. Using two drivers (both are lower or high frequency) at the same time can give 2 or 3 degree-of-freedom disturbances. The attenuation curves are shown and good effects can be deduced.