MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Microgravity Sciences Onboard the International Space Station and Beyond - Part 2 (7)

Author: Dr. zongfeng li
Technology and Engineering Center for Space Utilization, Chinese Academy of Sciences, China, lzfeng@csu.ac.cn

Dr. Wenbo Dong
Technology and Engineering Center for Space Utilization, Chinese Academy of Sciences, China, wbdong@csu.ac.cn
Prof. Weijia Ren
Technology and Engineering Center for Space Utilization, Chinese Academy of Sciences, China, renweijia@csu.ac.cn

NEW PROGRESS OF CHINESE MICROGRAVITY ACTIVE VIBRATION ISOLATION SYSTEM

Abstract

Earth-orbiting spacecraft provide the potential for a low level acceleration environment enabling microgravity science experiments in disciplines such as life sciences,materials science,fundamental physics,fluid and combustion sciencs.However,due to a variety of vibra-acoustic disturbances on spacecraft,the acceleration environment is usually exceed the requirements of many acceleration sensitive experiments. The need for vibration isolation systems is gaining increasing visibility. To date, many vibration isolation systems such as STABLE, ARIS, MIM and MVIS have been developed and tested on-board. China started development of microgravity active vibration isolation system(MAIS) from 2006 and have developed a engineering prototype in 2012. Now the first product is being developed and is planned to be launched Two years later. MAIS uses magnetic levitation technology to provides payload-level isolation. It is similar to a middeck locker type design, which is comprised of two major parts: the stator fixed to the spacecraft and the floater, which is a magnetically levitated platform onto which experiments are mounted. Stator transfers power and data signals to the floater by flexible umbilical cables which is the only mechanically link between the two. The enough sway space between the stator and floater is necessary to realize the desired microgravity vibration level. MAIS is actively controlled in six degrees of freedom using eight Lorentz actuators with magnets on the floater and voice coils on the stator. Nine accelerometers are used to monitor the stator and floater accelerations. Three position sensors is used to track the position and orientation of floater relative to the stator. A double-loop active control strategy is applied in the control system. A high-frequency control loop is implemeted to cancel the inertial accelerations and a low-frequency position loop is used to center the floater in the sway space and cause the experiment to follow the quasi-steady motion of the spacecraft. In order to improve system control precision, system reliability and maintenance, there are several improvements in flight product: firstly, Additional sensors are added to inprove the Component-level redundancy; secondly, A locking mechanism is provided which clamps the stator securely for periods of lauch and manoeuvre; thirdly, Due to the non-contact concept, the heat producted by payload and floater electronics must be dissiapted by meams of radiation in space environment, thermal design is reconsidered, In addition, MAIS electronics are modular in design to allow easy on ground or orbit maintenance and also provides the capability for an off-the-shelf kit for other applications.