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

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APPLICATION PROSPECTS OF MICROGRAVITY ACTIVE VIBRATION ISOLATION SYSTEM IN CHINESE SPACE STATION

Abstract

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 data, many vibration isolation systems such as STABLE, ARIS, MIM-12, g-LIMIT and MVIS have been developed and tested on-board mostly. China started to develop microgravity active vibration isolation system(MAIS) from 2006.Now the first product is planned to be launched in the TIANZHOU NO.1 flight mission. MAIS uses magnetic levitation technology to provides vibration isolation,which is comprised of two major parts:the stator,which is fixed to the spacecraft and the floater, which is the 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. In addtion, 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.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 of the 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 in flight product, there are several improvements: Additional sensors are added to improve the Component -level redundancy; A automatic locking mechanism is provided which clamps the stator securely for periods of lauch and manoeuvre; 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 orbit or ground maintenance.In the near future, China will build its own space station to develop large-scale space science experiments, the same technology can be delveloped to isolate experiment module in Fluid Physics Science Experiment Rack or other rack from vibration in the Chinese Space Station, we are developing the new construction and model design of MAIS to be suit for the vibration isolation requirement of FPSER.