

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

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NEW PROGRESS OF MICROGRAVITY ACTIVE VIBRATION ISOLATION SYSTEM IN CHINESE
TIANZHOU-1 CARGO SHIP

Abstract

Due to a variety of 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 flight model will be launched in the TIANZHOU-1 Cargo ship flight mission in 2017. MAIS uses magnetic levitation technology to provides vibration isolation, which is comprised of two equipment: the main body of MAIS and electric control box of MAIS. MAIS is actively controlled in six degrees of freedom using eight Lorentz actuators. Nine accelerometers are used to monitor the stator and oater accelerations, three position sensors is used to track the position and orientation of oater relative to the stator, A double-loop active control strategy is applied in the control of the system. A high-frequency control loop is implemented to cancel the inertial accelerations and a low-frequency position loop is used to center the oater 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; An automatic locking mechanism is provided which clamps the stator securely for periods of launch and maneuvers; Due to the non-contact concept, the heat produced by payload and oater electronics must be dissiated by means 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.