SPACE SYSTEMS SYMPOSIUM (D1)
Poster Session (P)

Author: Dr. Rui Li
Beijing Institute of Control Engineering, China Academy of Space Technology (CAST), China

Mr. Zhuang Ye
Beijing Institute of Control Engineering, China Academy of Space Technology (CAST), China
Prof. Youping Wang
Beijing Institute of Control Engineering, China Academy of Space Technology (CAST), China
Mr. Qiang Qu
Beijing Institute of Control Engineering, China Academy of Space Technology (CAST), China
Mr. Lei Liu
Beijing Institute of Control Engineering, China Academy of Space Technology (CAST), China
Dr. Qiang Zhang
Beijing Institute of Control Engineering, China Academy of Space Technology (CAST), China
Mr. Jikui Liu
Beijing Institute of Control Engineering, China Academy of Space Technology (CAST), China
Mr. Xiangang Meng
Beijing Institute of Control Engineering, China Academy of Space Technology (CAST), China
Dr. Ying Ding
Beijing Institute of Control Engineering, China Academy of Space Technology (CAST), China

DEVELOPMENT OF A NEW GENERATION HIGH RELIABILITY LONG LIFE SOLAR ARRAY DRIVE MECHANISM FOR FUTURE APPLICATIONS

Abstract

Solar Array Drive Mechanism (SADM) is a key component of the long life three-axis stabilization satellites, whose main function is to sustain and rotate the solar array for sunlight acquistion, as well as transfer power and signals from solar array to spacecraft body. Throughout the lifetime of satellites, SADM has to function continuously. Otherwise, satellites would lose power and cease functioning, so SADM needs extremely high reliability.

In recent years, with the development of the space technology, the onboard instruments and payloads of large spacecrafts such as large communication satellites and deep space explorers have become more complex. This poses more stringent requirements for the new generation SADMs compared to their existing predecessors. These requirements include higher reliability and safety standard, longer functional life, higher power transfer capability, more signal transfer channels, larger drive torque output, higher strength and stiffness, etc.

To satisfy the elevating requirements, a new generation SADM with high reliability and long life has been developed by Beijing Institute of Control Engineering, an affiliate of China Academy of Space Technology and China Aerospace Science and Technology Corporation, in 2010-2012, to satisfy the needs of the next generation spacecrafts. This new SADM features:

–High reliability design to mitigate the internal and surface charging and the subsequent discharging effects associated with the space environment

–Insulation against high voltage

–Specially developed epoxy for space radiation and extreme temperature environment

–Long life solid lubrication

–Multi-channel high power transfer slip-ring

–Multi-channel signal transfer slip-ring

–Stepper motor with large dirve torque output

–High stiffness bearing set

The development of the new generation SADM has gone through 4 stages:

(1)Conceptual Stage: Future spacecraft requirement identification, technical speciation determination, and the configuration design for the whole assembly.

(2) Subassembly Qualification Stage: Material development, mechanism design, manufacturing process research, functional and environmental testing for key subassemblies such as power transfer slip-ring, signal transfer slip-ring, bearing set, gear, motor, etc.

(3) Prototype Stage: Assembly and functional testing of a prototype.

(4) Engineering Model Stage: Assembly and environmental qualification of an engineering model.

This whole development process is summarzied in this paper.

This new generation high reliability long life SADM will serve as one of the core componenets of China's future spacecrafts for the years to come.