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Author: Dr. DA FAN
China Academy of Space Technology (CAST), China, fanda4312@sina.com

Mrs. Jian Song
China Academy of Space Technology (CAST), China, sjian8@sina.com
Dr. Chunshi FAN
China Academy of Space Technology (CAST), China, fancspim@gmail.com

STUDY ON THE SYSTEM OF A NOVEL SPACE BORNE ULTRA-QUIET PLATFORM OF DOUBLE DRAG-FREE BASED ON THE ELECTROSTATIC LEVITATION

Abstract

With the developing of the missions such as high resolution reconnaissance satellites, laser communication between satellites from an ultra-far distance and telescopes used in deep space, payloads on satellites require an ultra-quiet work environment to realize their performance of high precision. The effect of the micro vibration can't be ignored any longer. Two traditional methods of active vibration control, drag-free control and vibration reduction platform with feedback actuators, are introduced, and the principle, feature, developing and deficiency are analyzed. To overcome the shortages of the present methods, a space borne ultra-quiet platform of double drag-free based on the electrostatic levitation is proposed, which takes full advantage of the microgravity. Using the electrostatic levitation, the platform used for fixing precise loads and the vibrant satellite body-self are isolated without any mechanical connection. The electrostatic forces generated by the satellite body-self drives the platform to trace a levitation mass within the platform, and the micro thrusters drive the satellite body-self to trace the platform. Then a novel double drag-free frame is realized. The passive vibration isolation can be achieved with the extremely low electrostatic negative stiffness, and the precise active vibration isolation can be done by the controllable electrostatic forces. The active and passive vibration isolations are realized unitarily. The vibration of either high or low frequency can be decayed. Finally, a single axis double drag-free model is established by using Matlab/Simulink, and the simulation result shows that the novel method of vibration reduction is effective.