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MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures II - Development and Verification (Deployable and Dimensionally Stable Structures) (2)

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DEVELOPMENT OF A GRAVITY COMPENSATION SYSTEM FOR PROTOTYPE TESTS OF DEPLOYABLE SPACE STRUCTURES BY USING MULTI MOBILE ROBOTS

Abstract

In the recent year, the aerospace technology has quickly progressed all over the world. Many types of spacecraft are now planning and under construction. In this situation, the prototype tests are one of the important stage of the development of the spacecraft which have variable flexible structure severely require the prototype tests as well as numerical analyses. In performing the prototype tests on the earth, spacecraft require space qualification. However, the effect of gravity interferes with every structure on the earth, but in space the effect of gravity is ineffective. State of zero gravity is required to do the prototype test of spacecraft. On the other hand, due to the development of aerospace technologies, the prototype tests of spacecraft vary from small satellites to huge deep space explorers and the method of prototype test depends on the size and structure of spacecraft. Recently, it has been a large problem in the field of space engineering that the number of the prototype test sites is limited, the schedule in the prototype tests sites is almost saturated and the prototype test does require the specific facilities and huge costs. In this study, we propose a prototype test system for variable flexible spacecraft by using multi mobile robots with decentralized autonomous control system. The main purpose of this system is to create a state of zero gravity as well as possible. All the robot is autonomously controlled by using force control. All the robot provide force in opposite direction to gravity and the influence of gravity is reduced as well as possible. The feature of the system is its low cost and versatility. The system is applicable to the prototype test for small satellites, huge flexible space structures with many degrees of freedom by changing the number of modular robots according to the test conditions. The modular architecture and the portability of the robots reduce the cost of the system to set up the prototype test facility. In this study, the validity of the system is verified by the simple hardware model.