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CONTROL METHODS AND EVALUATION TESTS OF THE COILABLE MAST OF BUAA-SAT

Abstract

BUAA-SAT is a micro-satellite designed by students of Beihang University (BUAA) which will be launched in 2015. One of its missions is to verify the deployment of the self-designed coilable mast which can be compressed to the length of 0.1m and then deploy to 2m in orbit to realize the gravity gradient stabilization and stretch out equipment on the sub-sat.

As the impact during the deployment can be large, how to control the coilable mast is very important. Firstly a Lock & Release Mechanism is to lock the coilable mast before deployment and unlock it in orbit. Secondly the deployment process can be controlled by a rope, of which one end is fixed to the top of the mast, and the other end is connected to a rotary damper to reduce the velocity and shock during the deployment, which is simple and available. Lastly to avoid deployment failures caused by damper problems, a Thermal Knife Mechanism is designed to cut off the rope between the damper and the top of the coilable mast so that the coilable mast can still deploy though without control. This is very important because if the coilable mast cannot deploy, the other missions of BUAA-SAT such as the gravity gradient stabilization will be seriously influenced. What's more, the rotary encoder will feedback the deployment length in real time. The deployment can be finished in 20s, with an average force around 20N and periodic shocks about 30N.

Functional and environmental evaluation tests have been conducted to verify the performance of the coilable mast. A great many tests have been done, but in this paper we focus on the microgravity deployment tests and the thermal tests. Microgravity deployment test verifies the deployment performance of the coilable mast prototype and give reference to the chosen of the rotary damper. Thermal tests give the proper range of working temperature of the coilable mast and the rotary damper. Test method and results will be detailed presented in this paper.