

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Smart Materials and Adaptive Structures (5)

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A NON-EXPLOSIVE ACTUATOR FOR SMALL SATELLITE USING SHAPE MEMORY ALLOY
ACTUATORS.

Abstract

The pyrotechnic devices, which have been used for medium and large sized satellites, produce high shock and contaminants. Therefore, they so often cause malfunction in the satellite. Consequently, the pyrotechnic devices are not suitable for small satellites which have to have many components in small space. Therefore, there is a great deal of research activity for developing a non-explosive separation device. As another effort, we proposed a Non-Explosive Actuator(NEA) for the small satellite. The proposed NEA consists of two shape memory alloy(SMA) wire actuators for the main activation and the redundant activation, three springs, four rigid balls, the main body comprising first activation module and redundant activation module, and the release module. The release module is locked on the main body using rigid balls. As a SMA actuator is activated, the activation module is rotated. Then, a compression spring pushes the activation module to the slot on the main body. At that time, rigid balls keeping locking between the activation module and the release module come out to activation module. Finally, the release module is unlatched from the main body. Since the preload is one of main design parameters of NEA, a compression spring and a SMA actuator according to preload are selected through theoretical approaches to guarantee operation of NEA. Therefore, we could realize a low shock and reliable NEA for the small satellite. In addition, the NEA can be miniaturized and light by employing long SMA wire coiled around the activation module. Furthermore, the proposed NEA has two different actuators to be activated independently for the redundant function. In order to evaluate the performance of the proposed NEA, release time, shock level and proof load are investigated. Ground test is planned to verify a performance of the NEA based in European Satellite Agency test manual.