SPACE DEBRIS SYMPOSIUM (A6)
Hypervelocity Impacts and Protection (3)

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RESEARCH OF THE SPACE DEBRIS IMPACT DETECTING SYSTEM USED ON THE SPACE STATION

Abstract

The Space Station is a large -scale and long-term operation manned spacecraft, space debris poses a critical threat to the safety of the station and astronauts on board. In order tackle the threatens, a space debris impact detecting system based on acoustic emission(AE) technique is put out in the paper to monitor the station for space debris impacting in real time. In order to develop the detecting system based on AE technique, the character of AE wave excited by impacting of the space debris and the propagating laws of AE wave in the pressurized cabin structure should be solved in advance. So, firstly, the wave speed in pressurized cabin was measured using an imitation gun. According to the variation law of the measured speed, a fixed "nominal wave speed" was proposed to represent the variational wave speed. Secondly, the "virtual wave front source location method" was extended to compute the impact location of space debris on pressurized cabin, a series of locating experiments were carried out on pressurized cabin with an imitation gun, and the results indicated that the detecting method based on "nominal wave speed" and "virtual wave front source location method" can be used to detect the accurate impact site. Thirdly, a two stage light gas gun was used to carry out the hyper velocity impact test to simulate space debris impact pressurized cabin and get the character of the AE signal created by space debris by analyzing the hyper velocity impact AE signal. Finally, models of space debris impact pressurized cabin typical structure were created to study the propagate regular pattern of the AE signal in pressurized cabin. Based on the results of above tests, the transducer section method and the distribution law of transducers were developed; combined with "nominal wave speed" and "virtual wave front source location method", a space debris in suit detect system for Space Station was developed, the system can be used on Space Station to detect space debris impacting event.