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Impact-Induced Mission Effects and Risk Assessments (3)

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RESEARCH ON THE ANALYSIS METHOD OF FAILURE PROBABILITY CAUSED BY THE  
IMPACT OF SPACE DEBRIS

**Abstract**

Alone with the space debris environment deteriorating, the probability of the long-term in-orbit spacecraft impacted by space debris was greatly increased. Structural damage, functional failure or even disintegration may occur once the spacecraft is impacted by the space debris. Currently PNP (Probability of No Penetration) method, which the failure criterion is protective structure breakdown failure, is still used in the field of the space debris impact risk assessment project. PNP method cannot accurately describe the functional failure of the satellite components or reflect the influence degree for the satellite system function. Therefore, a more scientific index, vulnerability analysis, is needed to consider the functional failure of components and the function of the system. Based on the impact probability and penetration analysis of the satellite protective structure, the paper used the debris cloud engineering model and SRL ballistic limit equation, and the vulnerability analysis method for the functional failure of the satellite components and system level was established. In view of the internal components of the satellite, the functional failure criterion of SRL ballistic limit equation was selected, and the Ray-tracing method with the model of debris cloud was integrated. The problem was decomposed into two parts: within three-layer plates and above three-layer plates. The failure probability was calculated using corresponding method. The failure probability of typical components of the satellite was calculated.