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Author: Mr. Shubham Das
R V College of Engineering, Bengaluru, India

STUDYING THE EFFECTS OF SPACE ENVIRONMENTAL FACTORS ON THE FATIGUE BEHAVIOR OF A MATERIAL ON SPACECRAFT'S BODY

Abstract

In today's time, it is very important to the study and research about the effects of space environmental factors on the fatigue behavior of materials used in spacecrafts. Fatigue behavior refers to the way in which a material responds to repeated loading over time. The spacecrafts are subjected to a wide range of space environmental factors including temperature variations, exposure to atomic oxygen, radiation exposure, and micrometeoroid impacts which results into mechanical vibrations, thermal cycling, and stresses induced in the spacecraft's body which can impact the properties of the materials being used and damage the spacecraft's functioning. To study the effects of space environmental factors on the fatigue behavior of a material, a combination of experimental testing and computational modeling is required. This paper involves the study on experimental testing, subjecting samples of the material to various environmental conditions and monitoring their response over time. This is done using specialized test equipment, such as fatigue testing machines and environmental chambers. The study on Computational modeling method is also put into use, where computer simulations are used to predict the behavior of the material under different environmental conditions. This is done using finite element analysis (FEA) software, which allows to simulate the behavior of a material under different loading conditions and environmental factors. To conduct the study, materials commonly used in spacecraft construction, were selected and put into the experimental set up designed for the experimented conditions and put into different space environmental conditions such as thermal cycle loading, atomic oxygen exposure, radiation exposure and others and finally concluded with the fatigue testing. The tests resulted in showing the variation of the fatigue life of the materials owing to the various space environmental conditions to which they were tested. The study provides insights into the effect of space environmental factors on the fatigue behavior of materials used in spacecraft construction. The results of this study can help in the selection of suitable materials for spacecraft construction and in designing spacecraft that can withstand the harsh space environment.