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Author: Dr. Sichao Deng

China Academy of Launch Vehicle Technology (CALT), China, dengsichao89@126.com

Mr. xu zhenliang

China Academy of Launch Vehicle Technology (CALT), China, xuzhenliang1984@163.com

Mr. Shengbao WU

China Academy of Launch Vehicle Technology, China, wushengbao2003@163.com

Prof.Dr. Zhiping Yin

Northwestern Polytechnical University, China, yzp@nwpu.edu.cn

Mr. Shenghui Bai

Northwestern Polytechnical University, China, bai.shenghui@mail.nwpu.edu.cn

Dr. Liqiang Ai

China Academy of Launch Vehicle Technology (CALT), China, ailqiang1992@163.com

COMPILATION METHOD OF EQUAL DAMAGE ACCELERATED FATIGUE LOAD SPECTRUM  
FOR REUSABLE LAUNCH VEHICLE

**Abstract**

Reusable launch vehicle experiences severe and alternating loads. Fatigue load design is an important guarantee for the safety and reliability of reusable launch vehicle. The original fatigue load data of reusable launch vehicle are irregular with massive invalid load information. Using the original fatigue load data for test has large investment and long test cycle. This paper focuses on this problem and presents a compilation method of equal damage accelerated fatigue load spectrum for reusable launch vehicle.

Firstly, the irregular original fatigue load data are preprocessed to obtain the fatigue load history. The evolution trend of the mean value of fatigue load history is fitted by segments to obtain the mean value of fatigue load. The peak valley value sequence of fatigue load history is extracted and counted to obtain the fatigue load amplitude. The amplitude is extracted by Latin hypercube sampling method, and is randomly matched with the mean value to obtain the fatigue load cycle. Each fatigue load cycle is evaluated by the equal life curve. According to the characteristics of high load and low cycle number of reusable launch vehicle, the elimination threshold of fatigue load cycle is designed to delete the invalid load fatigue cycle causing less damage to the structure of reusable launch vehicle. Finally, the damage accelerated fatigue load spectrum of reusable launch vehicle is constructed.

By comparing the original fatigue load test and equal damage accelerated fatigue load test of standard structural samples, the structural damage equivalent results are basically the same, which verifies the correctness of the compilation method of damage accelerated fatigue load spectrum of reusable launch vehicle. This method could greatly shorten the loading period of fatigue load test and save the development cost, which has high engineering application value.