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A VHCF Life Prediction Method Based on Surface Crack Density for FRP

Tao Wu¹, Weixing Yao^{2,*}, Chao Xu¹

(1 Key Laboratory of Fundamental Science for National Defense-Advanced Design Technology of Flight Vehicle, Nanjing University of Aeronautics and Astronautics, Nanjing 210016, China;

2 State Key Laboratory of Mechanics and Control of Mechanical Structures, Nanjing University of Aeronautics and Astronautics, Nanjing 210016, China)

Abstract: In order to solve the difficulty of predicting very high cycle fatigue (VHCF) life of fiber reinforced plastic (FRP), a prediction method based on surface crack density is presented in this paper. According to the general rule of FRP fatigue damage evolution, the crack density is used to characterize the damage state of FRP in this method and further, the crack density-life evolution model of matrix can be established. The VHCF life prediction can be accomplished after obtaining the parameters in the evolution model through multi-load fatigue tests. The threshold of FRP fatigue strain is also assumed to exist in this paper. If the service strain level is lower than this threshold value, no new damage will occur after the matrix crack density reaches the characteristic damage state (CDS), which implies that FRP bearing below-threshold loads possesses an infinite life expectancy. In this paper, the very high cycle fatigue test of single-layer orthotropic woven CFRP has been carried out. The matrix crack density-life curve and the strain threshold of fatigue have been obtained by providing the rationality of this method.

Keywords: Composite, Very high cycle fatigue, Characteristic damage state, Fatigue life prediction

1. Introduction

FRP(Fiber reinforced plastic) materials are widely used in modern engineering structures due to their

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