Research on Engineering Analysis Method of Post-buckling Fatigue of Fuselage Panels

LiXiaopeng[1], ZhangYanjun[2], ZhuLiang[3], YangWeiping[4]
[1]*The First Aircraft Institute of AVIC, Xi'an, China*

The thin-walled reinforced structures are commonly used in aircraft fuselage panels. However, such structures are prone to post--buckling instability at lower stress levels, especially the structures of rear fuselage panels; shear instability occurs under the action of tail loads or other special repeated loads, which makes the sidewall repeatedly enter the tension field, resulting in post-buckling fatigue problems of the aircraft structures. This paper firstly analyzes the typical failure modes and mechanism of post-buckling fatigue of fuselage panels; then the principles are proposed that should be followed in the design of post-buckling fatigue of fuselage panels; at last, the typical tension field beam post-buckling fatigue test is designed to simulate and study the post-buckling fatigue problems of the fuselage panels. Based on the test results, a median generalized S-N curved surface characterized by tension field stresses σ_1 and σ_{eq} is established for post-buckling fatigue engineering analysis of fuselage panels. Also, the DFR value of post-buckling fatigue is derived based on test data, and relevant issues of post-buckling fatigue analysis of fuselage panels using DFR method are discussed.

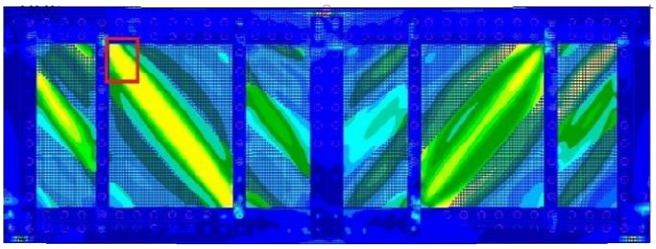

Figure1. Finite element post-buckling analysis of aircraft fuselage panels