

Influence of Bonded Crack Retarders on Damage Tolerance Performance of Aircraft Fuselage Panel

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The effect of bonded crack retarders on fatigue crack growth behavior and residual strength of fuselage panels was studied through the tests of 3 baseline panels (JZ-1, JZ-2 and JZ-3) and 3 reinforced panels (SR-1, SR-2 and SR-3). The baseline panels were curved fuselage panels with 7 stringers and 5 frames. As for the reinforced panels (Fig.1), crack retarders made of Glare-2 2/1 0.3 were bonded to the skin under each stringer and between adjacent stringers, along the direction of stringers. An initial circumferential skin crack with a length of 25.4mm was introduced in the middle of each panel. Fatigue crack growth tests were conducted at axial constant amplitude loads till the crack tips approached the adjacent stringers. Static tests were performed as well to determine the residual strength of the panels with two-bay skin crack. Significant retardation was found for the reinforced panels with bonded crack retarders, as shown in Fig.2. With the same skin stress, the average fatigue crack growth life of reinforced panels (SR-1 and SR-2) was about 2.7 times of that of baseline panels. The residual strength of reinforced panels was over 37% higher than that of baseline panels.

The fatigue crack growth behavior was also predicted based on finite element model and virtual crack closure technique. The residual strength was analyzed based on modified net-section criterion. Good consistence was found between prediction and experimental results. The mechanism of crack retardation and the influence of the location of bonded Glare straps were identified.

Keywords: crack retarder; curved fuselage panel; fatigue crack growth life; residual strength

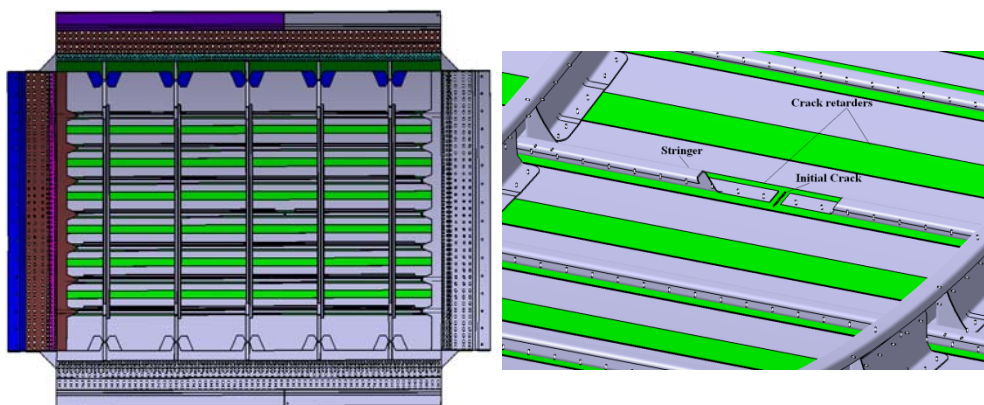
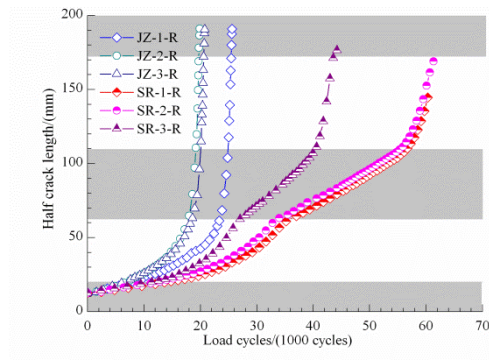
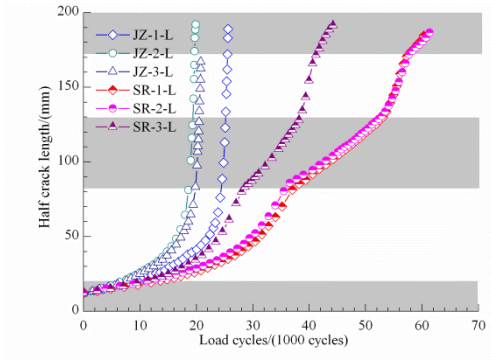


Fig.1 Configurations of test panel with bonded crack retarders



(a) Left side

(b) Right side

Fig. 2 Half crack length vs. load cycles (the grey areas represent retarder locations)