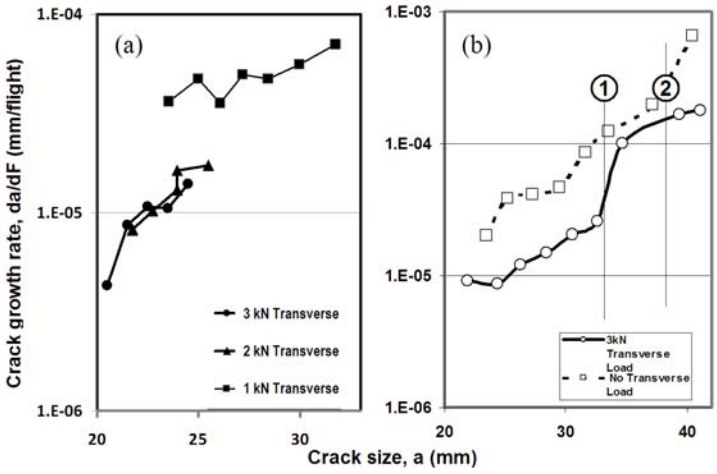
Fatigue Crack Growth under Flight Spectrum Loading with Superposed Fuselage Cabin Pressure

R. Sunder

BiSS Research, 41A, 1A Cross, AECS 2nd Stage, Bangalore 560094, India.
Email: rs@biss.in.

INTRODUCTION

The goal of this study was to investigate the growth of a circumferential crack in the upper panel of a pressurized fuselage cabin of a transport aircraft. The upper surface of the fuselage sees the same loads as the bottom surface of the wing. In case of pressurized cabins of transport aircraft, it will in addition, see the superposed action of internal pressure. Thus, the axial component of pressure-induced stress will add a tensile *offset* to the gust load spectrum. In addition, a hoop stress component that is *twice* the axial component will act in the transverse direction. This special case of biaxial loading involving tension-tension flight spectrum loading combined with a constant tensile transverse load was studied on cruciform test coupons cut from 2.7 mm thick 2024-T3 alloy sheet.



(a) Crack growth rates under spectrum loading at P_{mean} = 1.5 kN with superposition of forces from three different levels of cabin pressure. Transverse loads of 1, 2 and 3 kN were associated with axial load offset, P_{offs} = 0.5, 1, 1.5 kN respectively.

(b) Spectrum load crack growth rate versus crack size at P_{mean} = 1.5 kN and P_{offs} = 1.5 kN. Data obtained with transverse load 0 and 3 kN.

CONCLUSION

In conditions simulating increasing fuselage cabin pressure, the retarding effect of hoop stress induced transverse tensile load is more dominant than the adverse effect of the tensile offset in axial load, leading to lower crack growth rate, an effect confirmed by tests where only transverse load was varied.