SIMULATION AND DESIGN OF SPLICE JOINT IN FUSELAGE

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Abstract

In present work the correlation of Z-Stringer splice join present in Aircraft fuselage skin with three combination, they are metallic, composite and metallic and composite. The stringers are used in aircraft fuselage to avoid buckling of fuselage skin. The stringer is assembled to fuselage skin by bolts. The stringers are connected end to end by splice joint. The 3D modelling of stringer in ANSYS Workbench, by applying design condition for static structural for stress evaluation by finite element method for these combinations is made.

Keywords: *Aircraft, Fuselage, Stringers, Frames.*

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1. INTRODUCTION

Stringer is a little thin portion of material which is attached to the skin of the air ship. In the fuselage, stringers are connected to edges which are in the longitudinal heading of the aircraft. The biggest single thing of the fuselage structure is the skin and its stringer. It is additionally the most discriminating structure since it conveys the greater part of the essential loads because of fuselage twisting, shear, torsion and internal compression. End to end of stringers is connected by splice joint.

The investigations are carried out on splice joints for wing skin of a stringer in aircraft to find maximum stress concentration [1]. Fatigue life estimation [2], multi-site damage [3] and light fly of aircraft fuselage using composite material [4]-[5].

2. ANALYSIS USING ANSYS

1. The geometric construction of stringer is carried by using sketcher tool with particular dimensions.
2. After Geometric modelling the model is meshed by giving edge sizing for the model.
3. The Boundary conditions is applied for the meshed model for evaluation of results.
4. The stress and Deformation results are evaluated for the metallic and composite stringer.

3. GEOMETRIC MODELLING

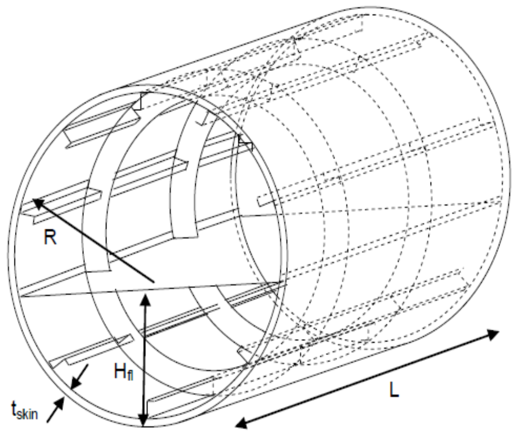

Fig 1 Wireframe of Fuselage

The above Figure shows the Wireframe structure of the Aircraft Fuselage, consists of stringer & frames.

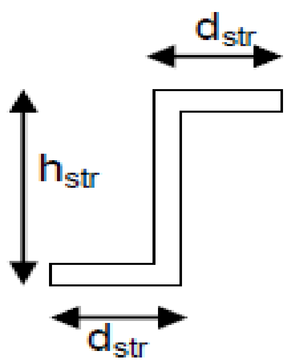

Fig 2 Stringer

The above Figure shows the section of stringer and Dimensions mentioned below.

3.1 Geometry of Stringer

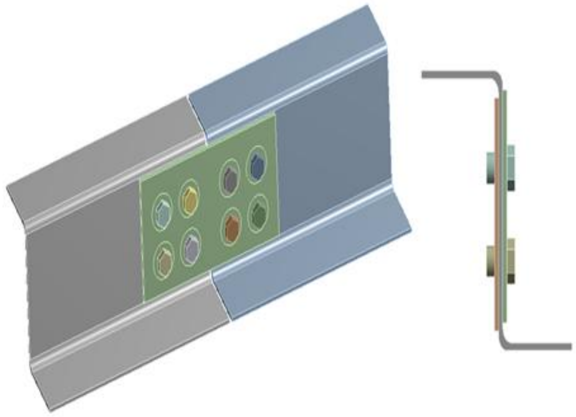

Fig 3 Modelled Stringer

The above Figure shows isometric and side view of modelled stringer.

Table – 1: Dimensions of the Stringer

Sl.No.	Name	Dimension
1	Stringer height (h_{str})	35mm
2	Stringer width (d_{str})	20mm
3	Stringer length	80mm each

Splice is 30mm wide and 60mm long
Bolt diameter 4mm

3.2 FE model of Stringer

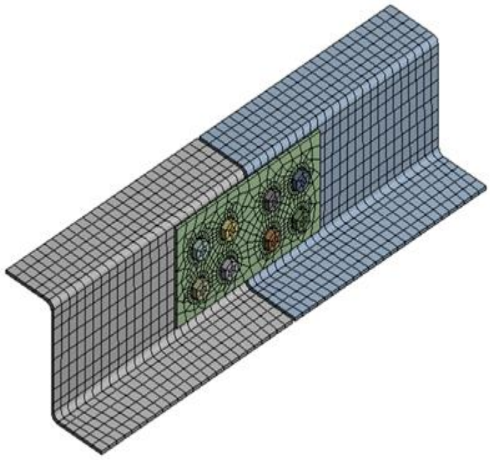

Fig 4 FE model

The meshed model of stringer is shown above which is having 6182 elements and 28674 nodes.

Nodes 28674
Elements 6182

3.3 Loads on Stringer

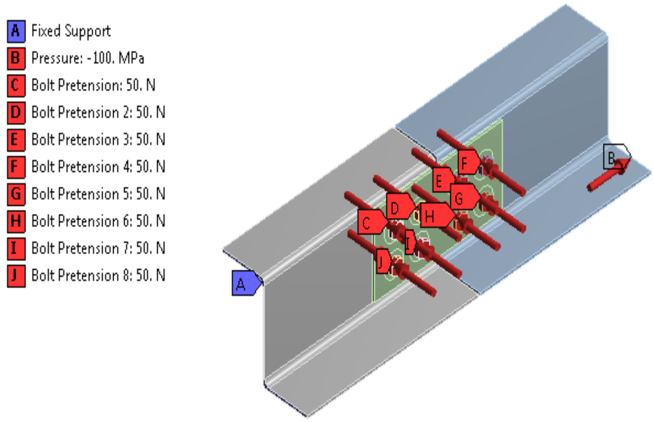

Fig 5 Loads on Stringer

The above Figure shows the loading condition of stringer, one end is fixed and other end is applied with the tensile load & bolt pre-tension is applied for the bolts.

4. RESULTS & DISCUSSION

4.1 Static Analysis

4.1.1 Metallic Z-Stringer

Stress on Stringer

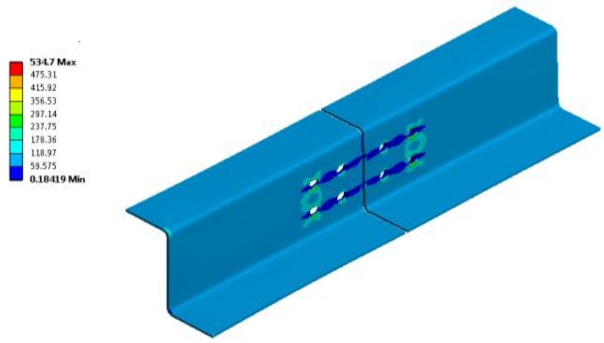

Fig 6 Stress 534.7Mpa

From the above it is observed that a stress result of metallic stringer is 534.7Mpa.

4.1.2 Analysis of Composite Splice joint

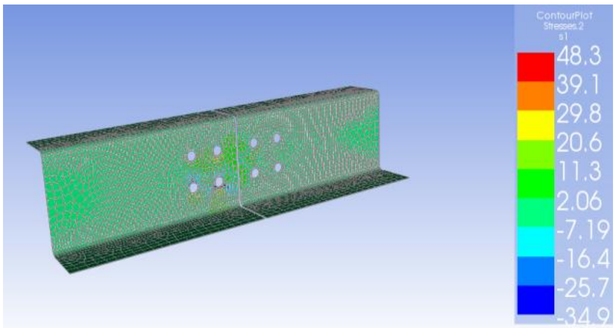

Fig 7 stress 48.3Mpa

From the above Figure it is observed that the stress result of composite stringer is 48.3Mpa.

4.2 Correlation of Metallic and Composite Stringer

Table – 2

	Metallic	**Composite**
Deformation	0.227mm	0.182mm
Stress	534Mpa	44Mpa

From the above comparison table it is clear that the stress and deformation in composite stringer is low compares to metallic stringer. Hence the composite stringer is preferable over metallic stringer for aircraft fuselage.

5. CONCLUSION

The development of stress in two combination of stringer is discussed. The static analysis is made to evaluate the stress and deformation of metallic and composite stringers. The metallic stringer will shows stress of 534Mpa and deformation of 0.227mm and composite stringer will shows stress of 44Mpa and deformation of 0.182mm. Finally conclude that the behaviour of splice joint of stringer in an aircraft fuselage structure composite stringer is more efficient and preferable compared to conventional material.

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