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Structural Analysis of Bulkhead

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Abstract - *Static analysis is performed in order to ensure that a structure will fulfill its intended function in a given loading environment. The structural analysis will guide the design of the aircraft and sizing of the components and provide a high degree of confidence. The analysis should be an integral part of the design process, thus minimizing design effort and time by eliminating redesign caused by failure during structural verification testing. An important benefit of performing analysis is the ability to determine design sensitivities and to conduct trade studies..*

Key Words*: *Structural analysis, Bulkhead, Aircraft.

1.INTRODUCTION

The present paper mainly carries the detailed analysis of wing attachment bulkhead structure of a transport aircraft (TA). Bulkhead is the machined component and where the wing front spar connects to it. According to loading point of view, it takes maximum bending loads and very little of shear.

Linear static analysis allows engineers to test different load conditions and their resulting stresses and deformation. Knowing how a design will perform under different conditions allows engineers to make changes prior to physical prototyping, thus saving both time and money. Linear static analysis is performed in order to ensure that a structure will fulfill its intended function in a given loading environment.

1.1 Statement of a problem

Linear static analysis of the wing attachment bulkhead for a given load condition. These can be achieved through the Finite Element methods, means by using different FE software's like Altair's hyper mesh, Optistruct Tool.

For Linear static analysis tested different load conditions and their resulting stresses and deformation.

Model of bulkhead is modeled using Solid Edge tool.The isometric view of Bulkhead.

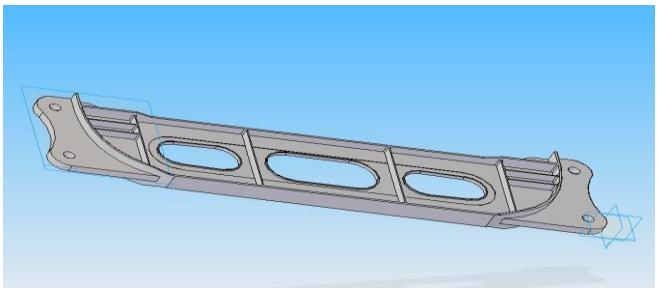

Fig -1: Isometric view of Bulkhead

1.2 Material and Method

The material used for bulkhead of aircraft is Aluminium 2024 T351.Following is the properties of material,

Table-1.Properties of Aluminium 2024 T351

Properties Type	Values in $\frac{N}{mm^2}$
F_{tu}(tension ultimate strength)	398.286
F_{ty}(tension yield strength)	296.4582
F_{cy}(compression yield strength)	241.2279
F_{su}(shear ultimate strength)	234.3609
F_{bru}(bearing ultimate strength)	592.9164
F_{bry}(bearing yield strength)	482.5539
μ,Poisions ratio	0.33(Dimensionless quantity)
E,Youngs modulus	68994.9072
ρ,Density	.026487 *10^{-3}

In order to find the stresses and deformation in Bulkhead different type of sets of loads used to do the linear static analysis. Linear static analysis is performed in order to ensure that a structure will fulfill its intended function in a given loading environment.

By performing different set of loading conditions, we found the particular set of loads to give the accurate results.

$Fx = 16.49\ kg = 161.7669N$,

$Fy = 13840.63\ kg = 135776.5803N$,

$Fz = 935.120\ kg = 9173.5272N$

So resultant load will be,

Fr = 13872.19 kg=136086.22093284N

2. Results and Discussion

Critical Case is the load in that material has max displacement and stress after that material will fracture.

Table-2. Results of Post Processing

Name of type of load	Max.Von mises Stress, N/mm^2	Max Displacement in mm	Margin of Safety in %
Critical Case	203.067	4.87	4169.7535

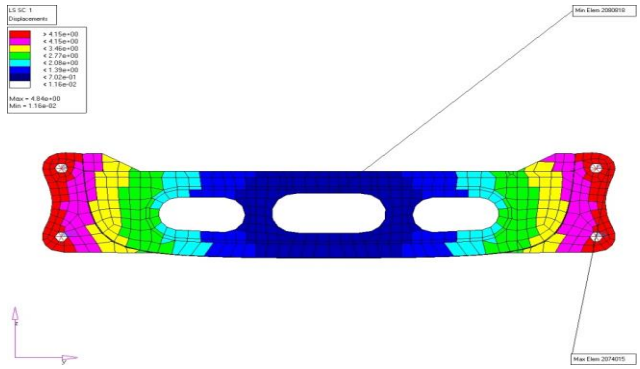

Fig -2: Von mises stress for critical case

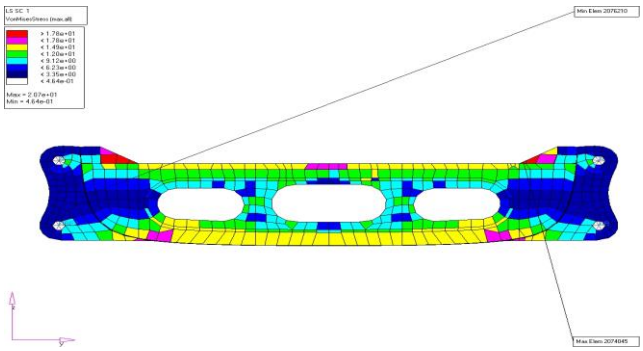

Fig -2: Max Displacement for critical case

3. CONCLUSIONS

The results of static analysis have shown that the maximum Von mises stress for aluminum component is 427MPa and in the web region it is found 220MPa.These stresses are compared with the ultimate stress of aluminum (430MPa) and it is found to be safe.

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