DESIGN AND ANALYSIS OF MEDIUM UTILITY AIRCRAFT LANDING GEAR

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Abstract

The landing gear is one of the critical components in aircraft and it is known that the majority of aircraft accidents happen due to failure of landing gear and also it is a complex dynamic system of several degrees of freedom.Accordingly for safety reasons the root causes of these failures must be well identified in order to avoid future accidents. Stress analysis is one of the important work in finding structural safety and integrity of a structure. In this work, initially the main landing gear strength calculation based on ultimate loads is carried out analytically. The stress failure exist in the intermediate zone between the support bearing of the wheels and the clamping of the axle to the nose of the aircraft. with the aim of determining the causes of the failure, a material analysis was performed The margin of safety for both major components such as axle, piston, cylinder, yoke as well as minor components such as toggle link, toggle fork, stub fork, bolts is determined. In FEA analysis the geometric model of MLG designed in CATIA is imported into Hyper Mesh. The model is meshed using tetrahedron element in Hyper Mesh. Also the line model is created from geometrical model and meshed in Hyper Mesh using 3D beam elements as mentioned in Fig.1. The stress analysis is carried out in Abacus. The displacement analysis done under different loading conditions as in table 1 to 3. Both analytical and FEA results for stresses are compared and it is find out that the factor by which the FEA and analytical results are varying. The margin of safety calculated by analytical work based on ultimate loads gives positive values as expected. The landing gear strength calculations by both analytical and FEA shows the maximum stress for different load conditions based on ultimate loads are well within the ultimate strength of that material mentioned in fig.2. It may encounter various vibration modes due to design features or frictional characteristics of brake.

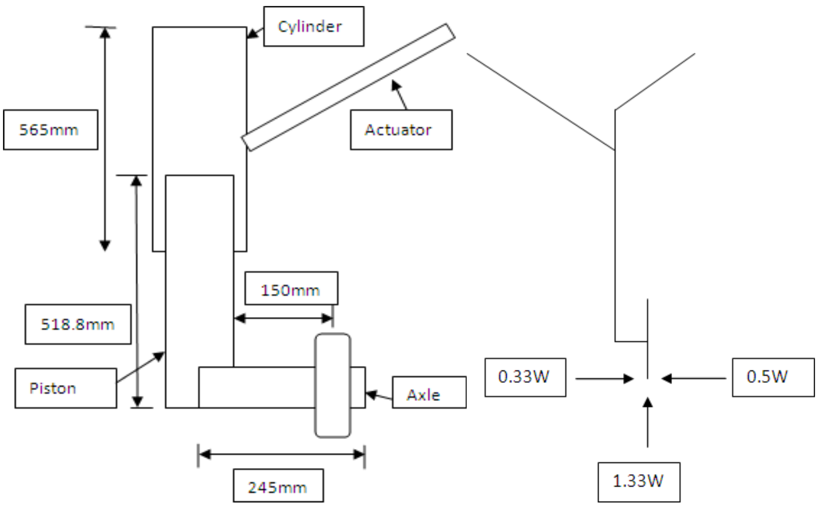

Fig.1.line diagram: A. modelling dimensions of major components B. Side loads during landing

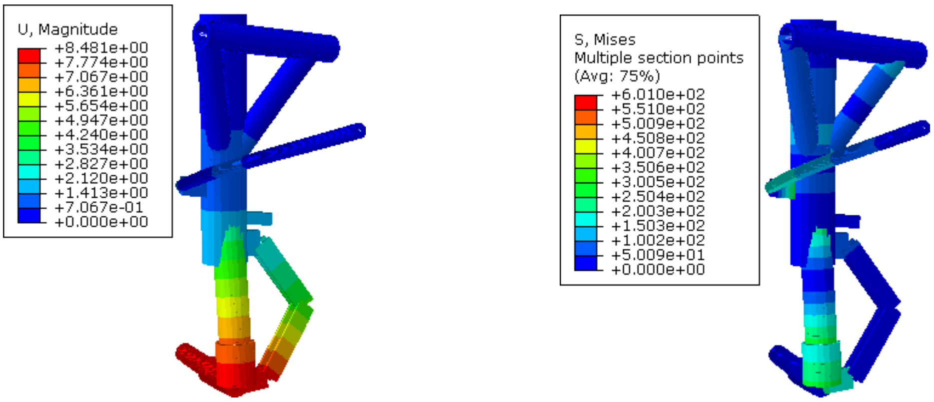

Fig.2. Resultant contours for side loads: A. Maximum displacement plot B. von-Mises stress plot

Table 1.Stress comparison for side load (inboard)

Component	FEA Stress (MPa)	Analytical stress(MPa)	Times(factor)
Axle	376.80	1009.48	2.68
Piston	601	1197	1.99
Cylinder	141.26	639.86	5.6
Yoke	114.36	326.14	2.85

Table 2. Stress comparison for spin-up

Component	FEA Stress (MPa)	Analytical stress(MPa)	Times(factor)
Axle	269.36	769.31	2.85
Piston	440.05	993	2.09
Cylinder	174.64	502.95	2.88
Yoke	278.35	255.12	0.92

Table 3. Stress comparison for maximum vertical loading

Component	FEA Stress (MPa)	Analytical stress(MPa)	Times(factor)
Axle	336.71	774.02	2.3
Piston	545.4	858.14	1.57
Cylinder	173.14	349.67	2.02
Yoke	210.07	244.64	1.16

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