Journal of
Polymer & Composites

ISSN: 2321-2810 (Online)
ISSN: 2321-8525 (Print)
Volume 11, Special Issue 8, 2023
DOI (Journal): 10.37591/JoPC

http://engineeringjournals.stmjournals.in/index.php/JoPC/index

Research JoPC

Conceptual Design and Static Model Analysis of Landing Gear

Ch. Sai Chand[1],*, S.S. Rao[2]

Abstract

An aircraft's landing gear system plays a critical role in effectively managing and dissipating kinetic energy generated during the landing impact, as well as mitigating vibrations induced by the aircraft's passage over irregular runway surfaces. This capability is indispensable for the proper functioning of a well-designed landing system. Among the various types of shock absorber landing gear systems employed in aircraft, the oleo-pneumatic shock absorber stands out as the most prevalent and widely adopted choice. It dissipates the kinetic energy generated by impacts when an aero plane lands quickly while also providing passengers with a comfortable ride when the plane taxis slowly. The purpose of this project is to calculate the stress, displacement, strain, and shear stress of three different nose landing gear designs made of various materials like Ti 6Al-6v-2sn, Ti10Al-2Fe-3V, Alloy steel 4340, Ti7Al4Mo, Ti6Al4V of an aircraft during landing using structural fem. For static and modal analysis, the landing gear was created using CATIA software and loaded into ANSYS. As boundary conditions, the working forces on the nose landing gear were used. Finally, based on the, it was determined which material is appropriate for landing gear. Find the total deformation at various frequencies using static analysis and modal analysis using the stress, displacement, strain, and shear stress data.

Keywords: Landing gear, Stress, displacement, ANSYS tool

INTRODUCTION

The function of an aircraft's landing gear is to act as a support structure during takeoff, landing, and taxiing. Its construction is intended to diffuse and absorb the kinetic energy of landing impacts, so minimizing the effect loads applied to the airframe. Airplanes are one of the best development of human as it is a profoundly mind boggling item. Having such a vehicle is extremely valuable for simple and agreeable goes over the world. Airplanes are utilized in different manners; they are use in business reason just as military reason. It for the most part diminishes time of venture out and give extravagance to the travelers additionally the creation and utilizing of airplanes gave bunches of employability choices. An airplane is made up of several parts and supporting structures that work together to make it fly. A portion of the principle parts are fuselage, landing gears, cockpit, wings, motor, ailerons, rudder and so forth all the parts were caused remembering that the item to need to fly somewhere down in sky so weight, stresses, twisting and so on are taking in thought before assembling the parts. Remembering these things a plan of every part and framework was made and material determination must be done admirably. To make an airplane extreme, solid, and light now a days, structure and examination were done in virtual products. Before assembling each part and sub framework were structured and broke down to show signs of improvement results and it is a lot simpler to be corrected. One of an airplane's most crucial components is the landing gear structure,

***Author for Correspondence**
Ch. Sai Chand

[1]M.Tech Student, Department of Mechanical Engineering, KLEF University, Vijayawada. Andhra Pradesh, India
[2]Professor, Department of Mechanical Engineering, KLEF University, Vijayawada. Andhra Pradesh, India

Received Date: July 24, 2023
Accepted Date: October 19, 2023
Published Date: February 22, 2024

Citation: Ch. Sai Chand, S.S. Rao. Conceptual Design and Static Model Analysis of Landing Gear. Journal of Polymer & Composites. 2023; 11(Special Issue 8): S145–S163.

which supports the aircraft's load while it isn't in flight and enables safe takeoff, landing, and taxiing. Wheels are normally utilized however slides, skis, coasts or a blend of these and different components can be sent depending both on a superficial level and on whether the specialty just works vertically (VTOL) or can taxi along the surface.

Quicker airplane as a rule has retractable undercarriages, which overlays away during trip to diminish air opposition or drag. Airplane landing gear as a rule incorporates wheels furnished with basic safeguards, or further developed air/oil oleo swaggers, for runway and unpleasant territory landing. Some airplanes are furnished with skis for day off buoys for water, as well as slips or boats (helicopters). The undercarriage is a generally overwhelming piece of the vehicle; it very well may be as much as 7% of the drop weight, yet more normally is 4–5%.

LANDING GEAR ARRANGEMENT

Airplane landing gear bolsters the whole weight of an airplane during landing and ground activities. They are appended to essential basic individuals from the airplane. The kind of apparatus relies upon the airplane plan and its proposed use. The majority of landing gear has wheels to facilitate movement to and from hard surfaces, such runways at airports. Other rigging highlight slides for this reason, for example, those found on helicopters, expand gondolas, and in the tail territory of some tail dragger airplane. Airplane that work to and from solidified lakes and cold territories might be furnished with landing gear that have skis. Airplane that work to and from the outside of water have barge type landing gear. Despite the kind of landing gear used, stun retaining hardware, brakes, withdrawal systems, controls, cautioning gadgets, cowling, fairings, and basic individuals important to join the apparatus to the airplane are viewed as parts of the arrival gear framework.

LITERATURE REVIEW

In a study conducted Freymann, R. et al. [1], the landing gear assembly was modeled and examined using SOLID WORKS and the ANSYS package. A limited component approach was utilized to design the CAD Model, which was then subjected to basic examination cycles. Additional investigation was conducted on the landing gear assembly using three different materials: Titanium alloy 6A1-4 V, 7075-76 Aluminium compound, and SAE 1035 Steel. The results of the study showed that SAE 1035 Steel outperformed the other materials in terms of parameters such as twisting and anxiety. The material also exhibited a lower miss rate, with approximately 35% reduction in deformation compared to the other materials. This suggests that SAE 1035 Steel is a more reliable material for preventing landing gear damage and has a longer lifespan than the other materials examined. The study conducted by JITHIN Toloei et al. [2] aimed to utilize Finite Element Analysis (FEA) to minimize the maximum pressure estimation on the nose landing gear of a small aircraft designed to carry up to 30 passengers. The investigation was guided by the landing gear design created in CATIA software and analyzed using ANSYS. The maximum take off load was considered for all landing gears, with the nose landing gear bearing around 12% of this load.

Xu, D.L. et al. [3] conducted a study on the landing gear of aircraft and identified the new challenges that arise when the plane touches down due to the upward push. The study revealed that landing gear may collapse under yield point stresses due to repetitive concerns, which could result in damage to the plane if the landing roll fails. Therefore, it is crucial to make the landing gear shock-resistant upon landing and to determine the maximum induced pressure. In this aircraft project model, the landing gear was designed, and the maximum pressure and maximum displacement were determined. An analysis utilizing ANSYS Workbench software was performed by WIBAWA [4] to determine the effect of fillet radius on the static stress and fatigue life of an unmanned aerial vehicle (UAV) main landing gear. The landing gear, composed of the aluminium alloy 6061, had its radius altered to 120, 130, 140, and 150 mm. The study found that increasing the fillet radius of the landing gear resulted in an increase in Von Misses stress and fatigue life. DURMUSOGLU [5] conducted an impact analysis on the landing gear due to its exposure to impact loading during landings. The materials used in the study were Aluminium 7075-T6 and Titanium (Ti553). ANSYS analyses revealed that the titanium alloy material exhibited a longer fatigue life and lower total deformation than Aluminium 7075-T6. YETKIN AND KOCA [6] conducted a study to examine the impact of shaft radius and moment on landing gear stress and deformation. The study found that increasing the shaft radius resulted in a decrease in the maximum stress, while the maximum deformation increased. Additionally, the maximum stress and maximum deformation increased as the moment applied to the landing gear cylinder increased. JEEVANANTHAM et al. [7] designed the landing gear for a Boeing aircraft using ANSA software and then analyzed it using ANSYS software. The study compared the performance of several materials, including Aluminium Alloy 7075, Steel 4340, Ti-6AL4V, Ti-6AL-6V-2Sn, and Ti-10Al-2Fe-3V. The titanium alloy landing gear exhibited remarkably low maximum stress and deformation values.

In a comprehensive study by khot NS, Venkayya V. [8], balanced landing sway stacks were thoroughly examined with a focus on characterizing basic stacking cases for nose wheel landing gears. A direct spring was utilized to represent the tire-safety combination of the nose wheel landing gear, while speed squared damping powers were used to represent the damping properties of the basic wheel landing gear. Direct springs represented the wheel and safeguard spring qualities while disregarding the unstrung mass. Additionally, the study recognized the drop test translation issue of how to account for static lift forces.

OBJECTIVE OF THE PROJECT

The aim of this research is to enhance our comprehension of the construction of landing gear by analyzing its structure. In particular, the study focuses on conducting a structural analysis of different types of landing gear. The research aims to determine the most suitable material for constructing landing gear by investigating the stress, deformation, strain, and shear stress caused by various loading conditions. Additionally, the study seeks to identify the frequencies in modal analysis caused by the deformation. CATIA software was used to create three designs for the nose landing gears, which were then analyzed using ANSYS 15. Perform structural analysis on a structure to determine stresses, deformation, shear stress, and strain under design load conditions. The modal analysis determines the total deformation at various frequencies. Finally concluded the suitable materials of the landing gear in these materials Ti 6Al-6v-2sn, Ti10Al-2Fe-3V, Alloy steel 4340, Ti7Al4Mo, Ti6Al4V Comparing the graphs of the three designs and five materials.

METHODOLOGY

The landing gear will be examined for different materials. By applying a force during the landing, ANSYS 16.2 will be used to test the landing gear made of various alloys [9–12]. The total deformation, Vonmisses stress, shear stress, and strain for various alloys was calculated after the boundary conditions were applied. The methodology of proposed design is shown in Figure 1.

LEAD SPECIFICATIONS OF CIVIL TRANSPORT AIRCRAFT

The aeroplane handbook is where the specs for the aircraft come from. The landing gear has been created to meet the requirements. Below is a step-by-step process for designing the landing gear. The following are the specifications of the aircraft: the maximum takeoff weight is 18,000 kg, the diameter of the propeller is 3.8 m, and the wing has a span (S) of 60 m². The aircraft has an aspect ratio (AR) of 12, and its airfoil follows the NACA 6 series. The forward center of gravity (CG) is located at 18% of the mean aerodynamic chord, while the about freaking time CG is located at 30% of the mean aerodynamic chord. The distance between the main gear and the forward CG is 1.916 m, while the distance between the main gear and the aft CG is 1.827 m.

PROBLEM IDENTIFICATION

Inadequate material is the cause of failure. Steel materials are heavy and corrosive. Titanium alloys are extremely strong materials. We chose steel, aluminum, and titanium materials for this project and compared them all. We eventually determined that titanium is the best material because it has the lowest stress, strain, and shear stresses. The literature claims that a substantial amount of study has been done on landing gear. It has been established that there is a need to overcome issues associated with competing requirements such as landing gear strength and stiffness while also being able to withstand aircraft weight impact and avoid structural damage during landing. Researchers have proposed materials that can withstand the aircraft's weight impact, such as aluminum, titanium, magnesium and others.

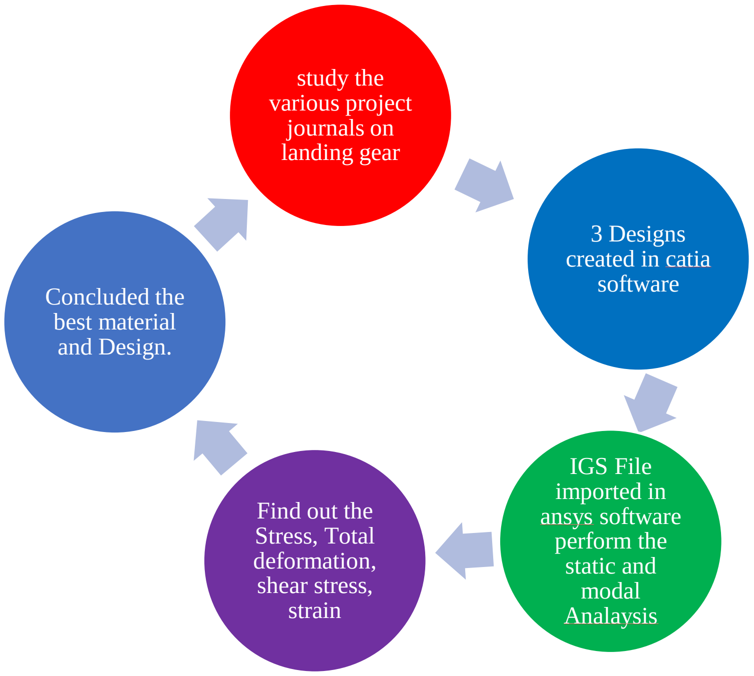


Figure 1. Methodology of proposed design.

MATERIAL PROPERTIES:

The various material properties are given in the Table 1.

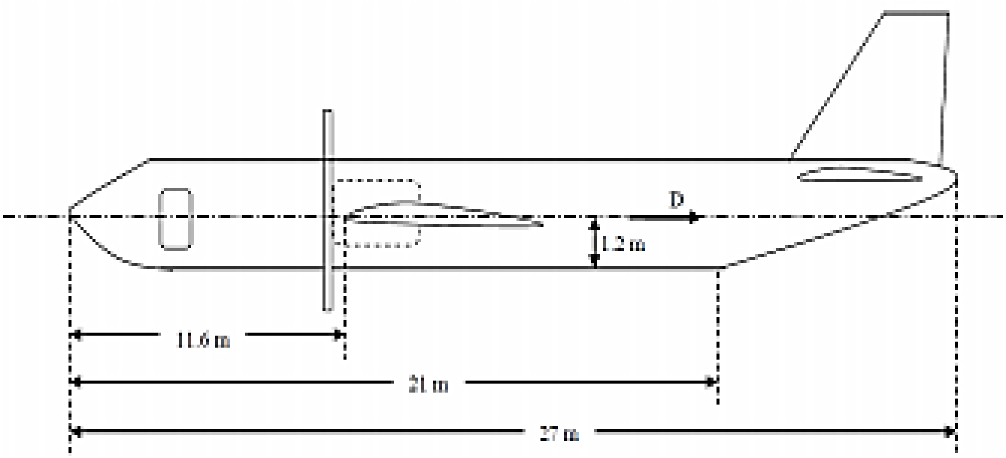


Figure 2. Specifications of proposed design.

LEAD SPECIFICATIONS OF CIVIL TRANSPORT AIRCRAFT

To design the landing gear, the aircraft specifications are obtained from the aircraft manual book. The landing gear is then designed based on these specifications. The below Figure 2 is a detailed procedure for designing the landing gear.

Maximum takeoff weight = 18,000 kg, Diameter of the Propeller = 3.8 m Wing: Span (S) = 60 m^2, NACA 6 series Aspect Ratio (AR) = 12, Forward CG = 18% of mean Aerodynamic chord After CG = 30% of Mean aerodynamic chord. Distance b/w main gear and forward CG = 1.916 m Distance b/w main Gear and after CG = 1.827 m

LOAD CALCULATION

Load on nose gear:

$$Fn = 0.15 \times W$$
$$= 2700 \text{ kg}$$
$$\mathbf{= 26487\ N}$$

Load on Main gear:

$$Fm = 0.85 \times W$$
$$= 15{,}300 \text{ kg}$$
$$\mathbf{= 150093\ N}$$

DESIGN CONCEPT OF LANDINGGEAR

The inception of a conceptual design commences with a comprehensive examination of all design specifications and the adherence to airworthiness regulations. Subsequently, the concept takes shape while aligning with functional imperatives and regulatory stipulations. Key considerations encompass performance optimization, safety assurance, cost containment, adherence to timelines, technological feasibility, and resource availability. The precise landing gear placement is determined, and the landing gear type is judiciously chosen. Furthermore, the landing gear's geometric configuration and kinematic properties are meticulously delineated. This phase also encompasses the exploration of steering concepts. Dynamic simulations come into play to approximate ground loads, facilitating material selection and preliminary component sizing. Concurrently, the mechanisms for actuation and load management are meticulously developed in this stage. To improve weight, volume, and cost, various tradeoff studies are conducted. These trade-off analyses are used to determine which concept is best.

SHOCK STRUT (UPPER OUTERCYLINDER)

Select the XY plane from the Sketcher workbench. Using the dimensions listed below, create half of the view. Go to the sketch-based features part design workbench now. Use the shaft option, apply a 360-degree angle, and return to the sketcher to draw the top side hinge shape based on the dimensions [13–17]. The Figures 3 and 4 showing that the pad in the part designed and create the bottom link in the sketcher workbench based on the dimensions.

Table 1. Different material properties.

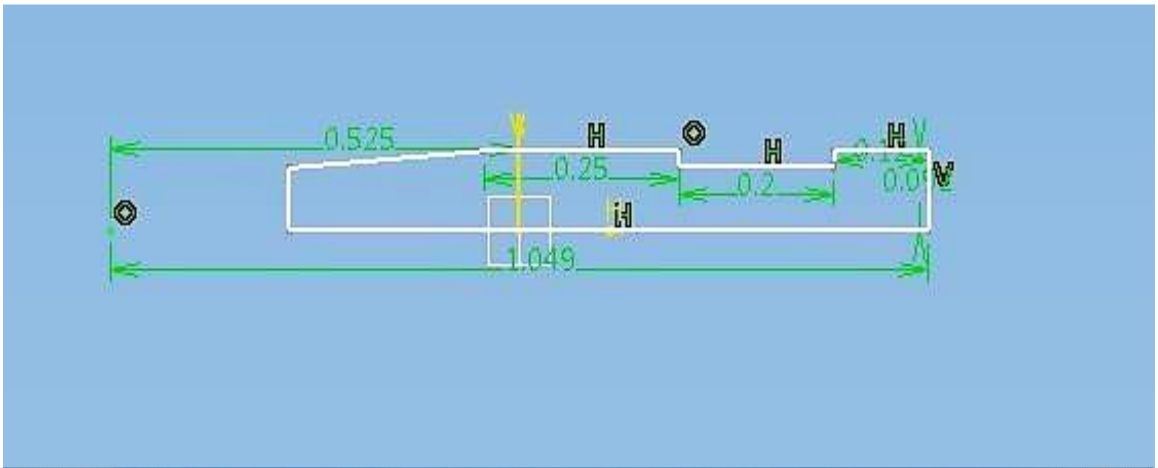
Materials	Density Kg/m^2	Possions Ratio (μ)	Youngs Modulus (Mpa)	Ultimate Tensile Strength (Mpa)	References
Ti6Al-6v-2sn	4540	0.32	110000	1050	[9]
TiI0Al-2Fe-3V	4650	0.32	108000	970	[10]
Alloy steel 4340	7850	0.3	210000	754	[13]
Ti7Al4Mo	4480	0.32	116000	896	[15]
Ti6Al4V	4430	0.34	113800	950	[17]

SHOCK STRUCT LOWER INNER CYLINDER (PISTON)

Go to the sketcher workbench create the circle now go the part design workbench apply pad now go to the YZ plane create the circle apply pad as per dimensions now again go to the sketcher create the circle and small circle axle holder as shown the below Figure 5.

AXLESHAFT

Go to the sketcher workbench create the half of the axle shaft with dimension after go to the part design workbench apply shaft option as shown below Figure 6.



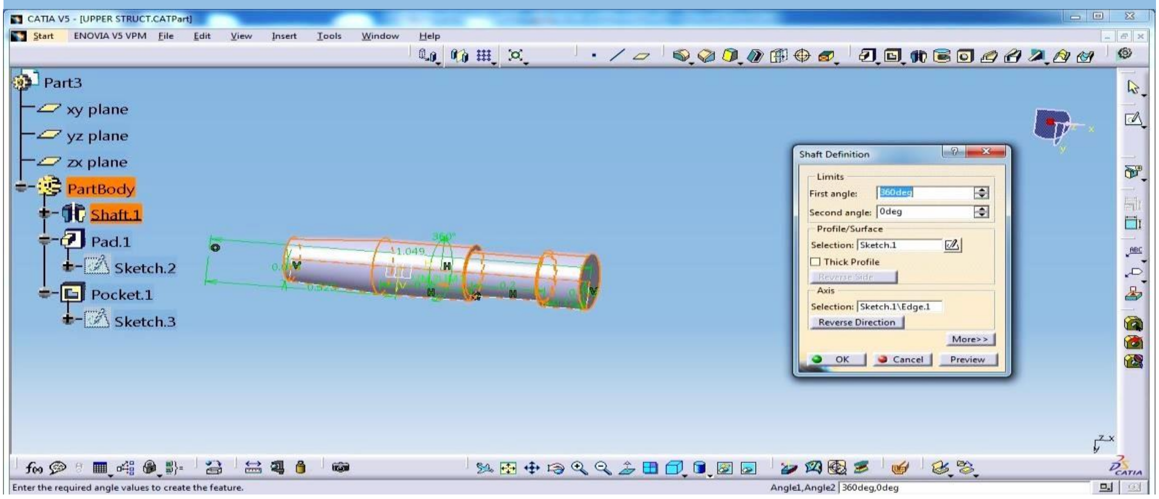


Figure 3. Upper outer cylinder designed in part design.

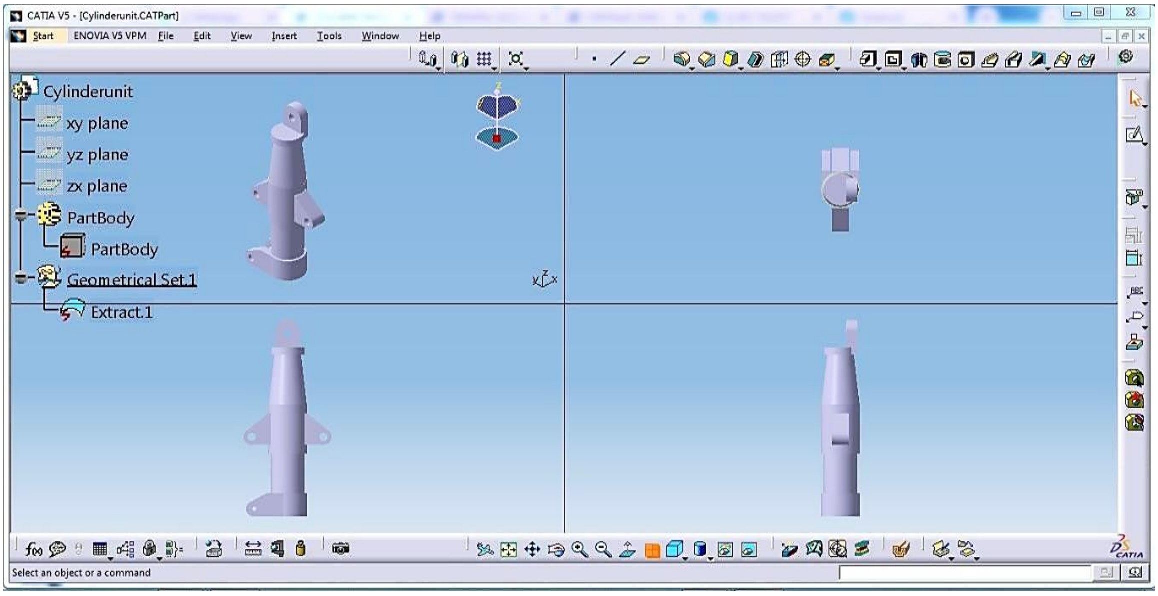


Figure 4. Upper outer cylinder final view designed in CATIA.

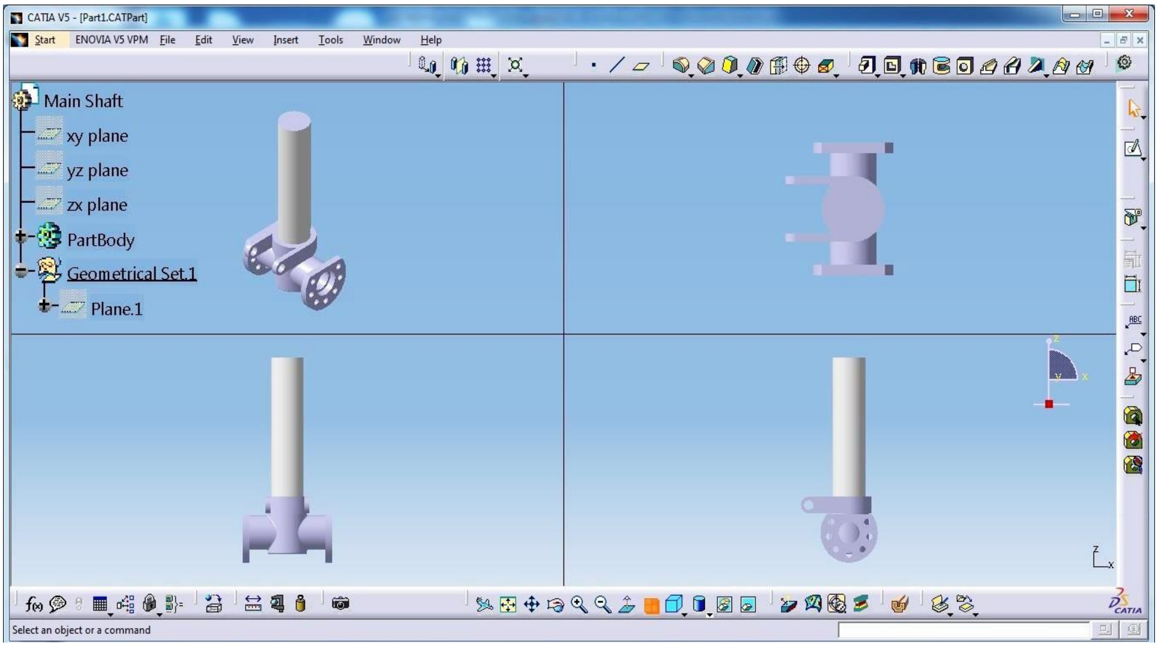


Figure 5. Shock structure lower inner cylinder.

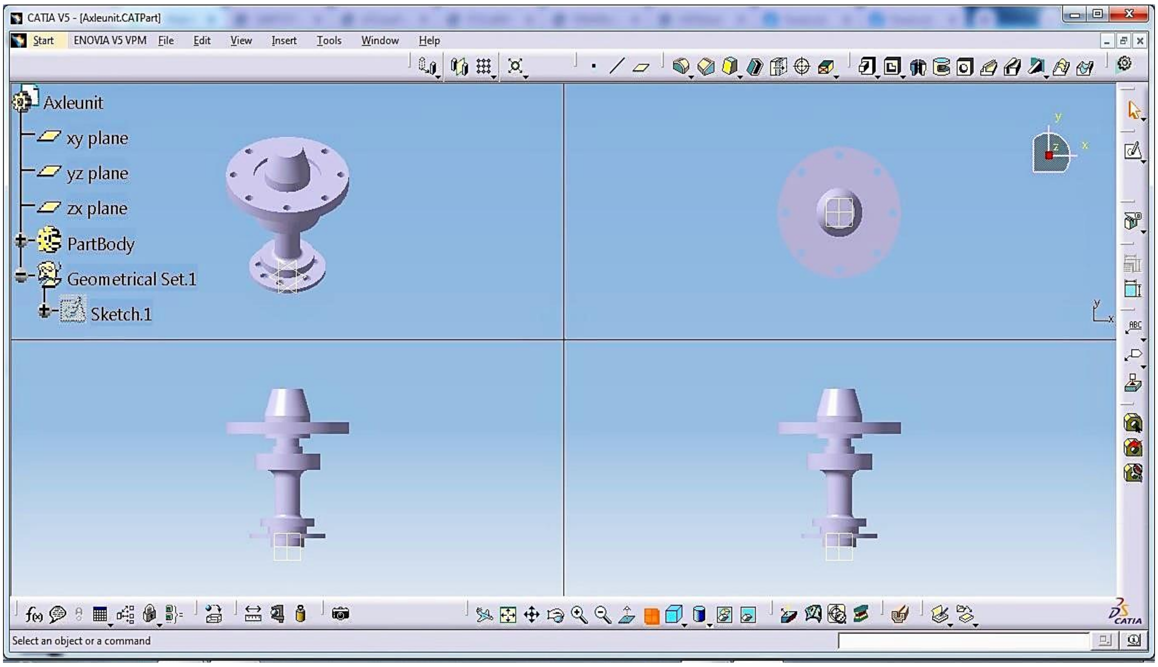


Figure 6. Axle shaft designed in CATIA.

DISCHUB

Draw two circles according to the dimensions on the sketcher workbench, then select the pad option and apply a thickness of 20 mm. Return to the sketcher workbench and draw two small circles, then select the circular pattern option, and finally draw two cylinders with the dimensions shown in the Figure 7.

LINK

Create the two circles in sketcher workbench thickness is 35 and radius of the link outer hinge in 35 mm angle is 60 now go to the part design work bench apply pad is 48 mm, the designs are shown in below Figures 8–11.

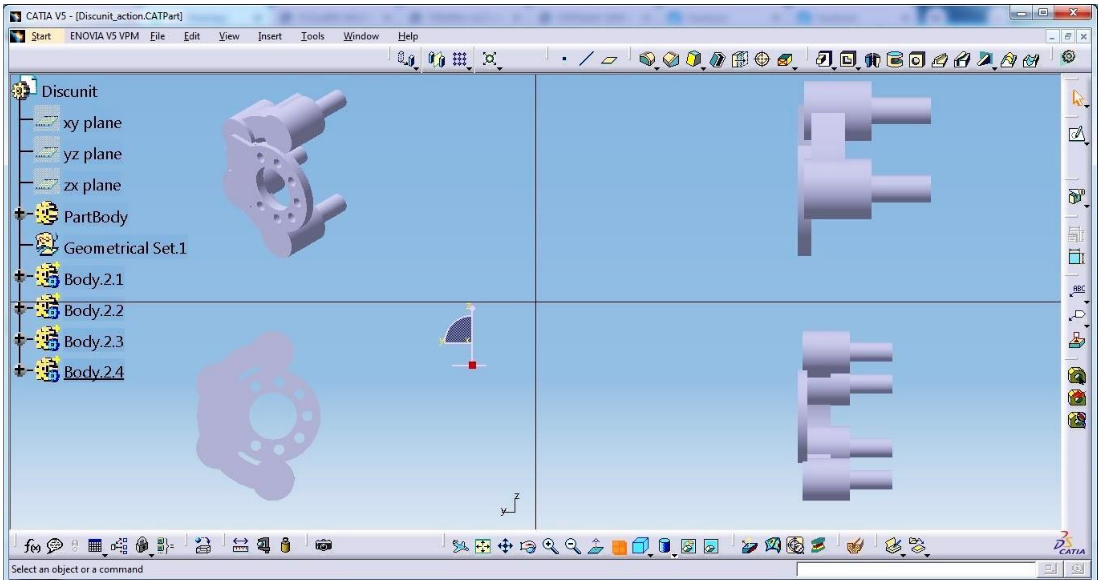


Figure 7. Disc hub designed in CATIA.

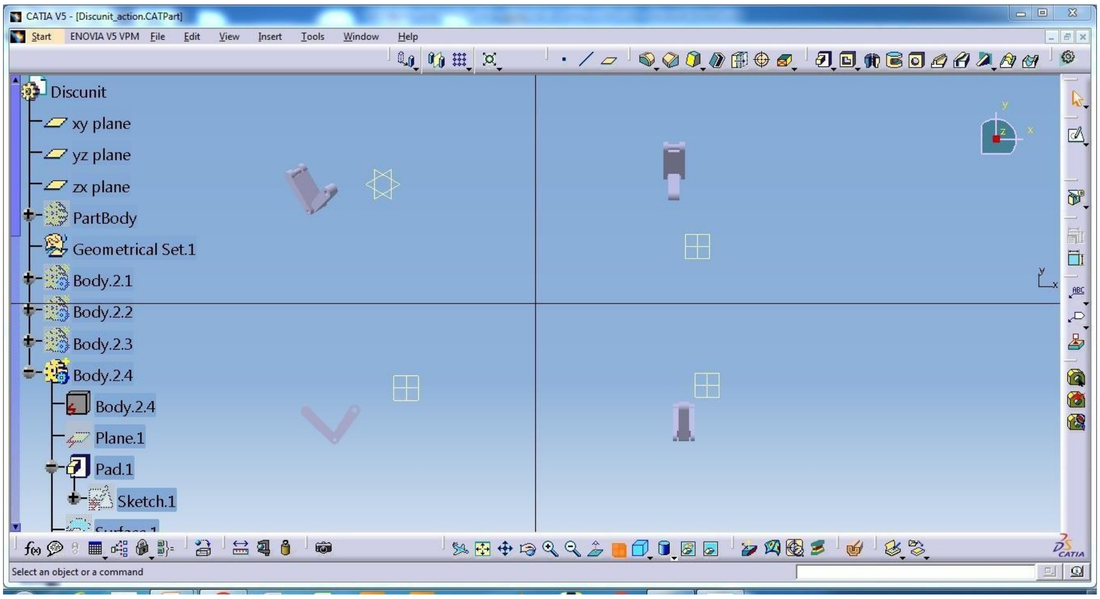


Figure 8. Link design in CATIA workbench.

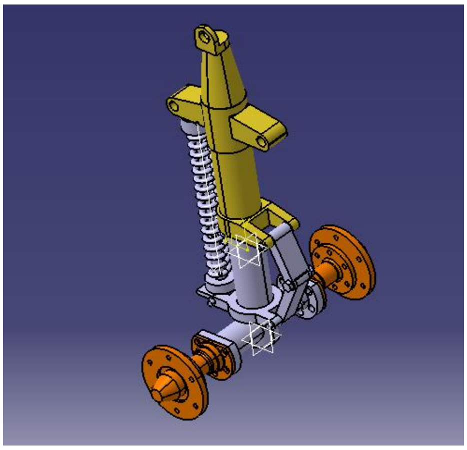


Figure 9. Proposed design 1.

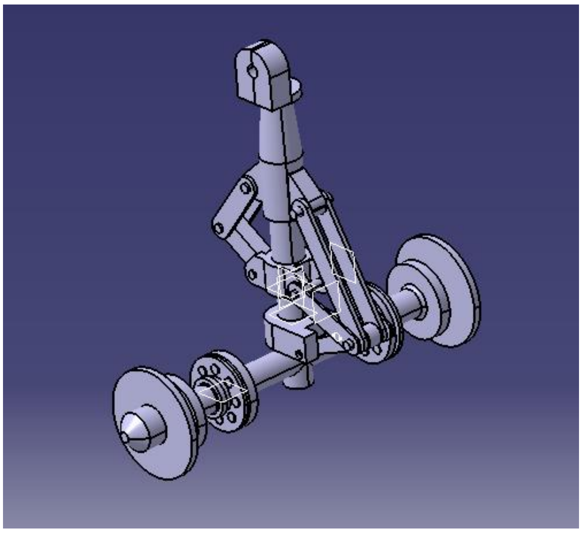


Figure 10. Proposed design 2.

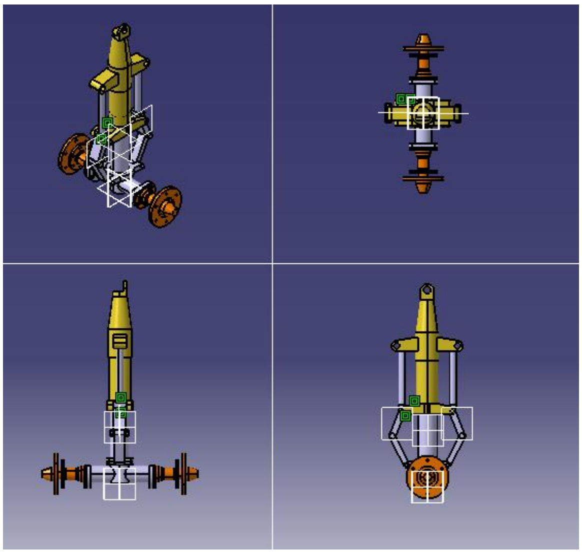


Figure 11. Proposed design 3.

STATIC ANALYSIS

Static analysis is a method for evaluating the behavior of a structure under constant loading conditions, disregarding the influence of inertia and damping resulting from time-varying loads. Nonetheless, static analysis has the capacity to evaluate a spectrum of conditions, encompassing enduring inertial forces, such as gravitational and rotational velocity influences. It also accommodates dynamic scenarios, where time-varying loads are approximated as static equivalents. These static equivalents often emulate persistent forces, like the static equivalent wind and seismic loads, which are typically delineated within assorted building codes.

ANALYSIS PROCEDURE IN ANSYS

Select the steady state thermal analysis after importing the CATIA workbench component into ANSYS workbench as Engineering Materials (Material Properties), Create or import geometry, Model (apply meshing), Setup (boundary conditions), Solution and Results.

MESH AND BOUNDARY CONDITIONS

The different type of meshing is applied in the various designs, these are shown in below Figures 12–17.

Conceptual design 1

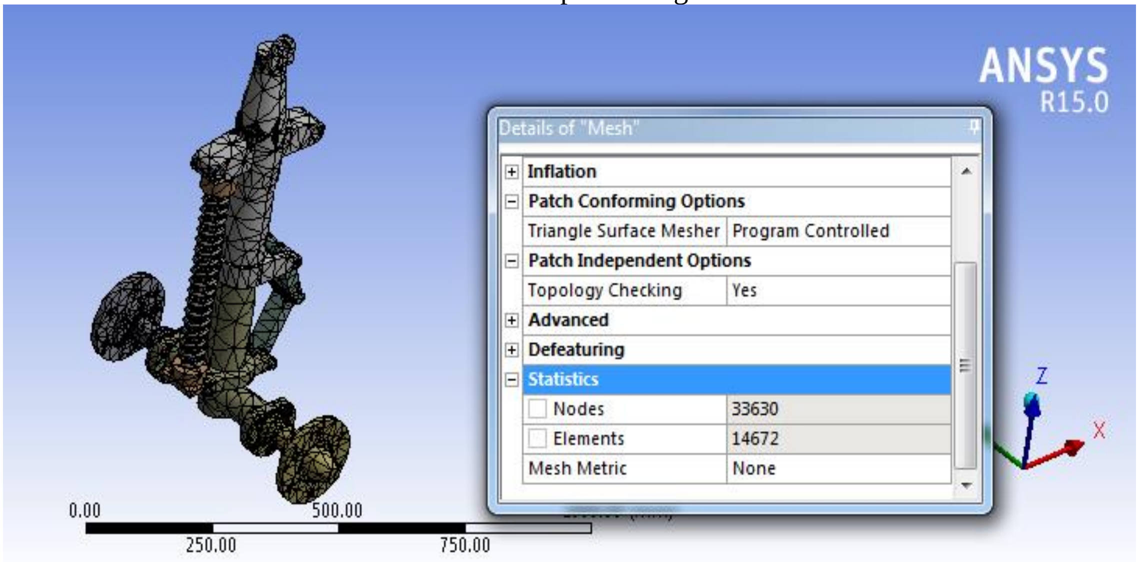


Figure 12. Mesh nodes: 33630, Elements: 14672.

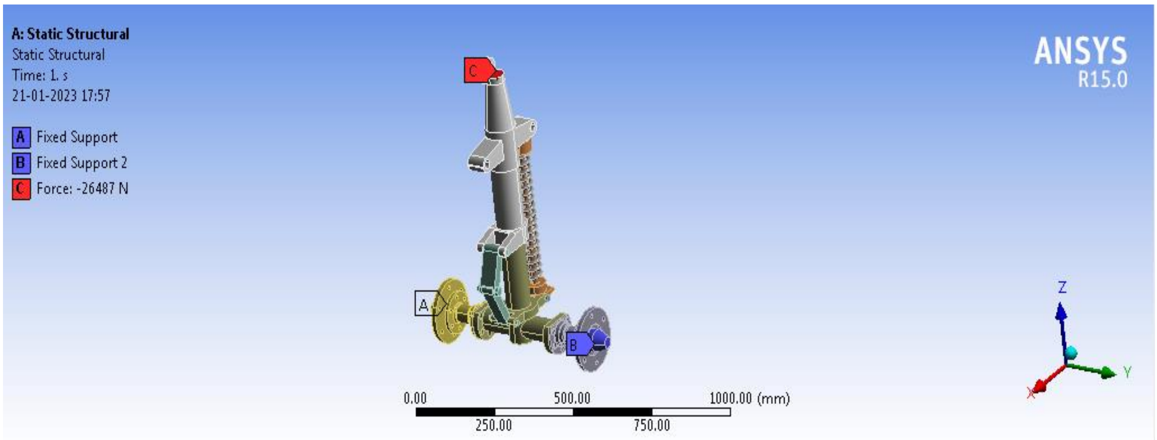


Figure 13. Boundary condition 26487.

Conceptual Design 2

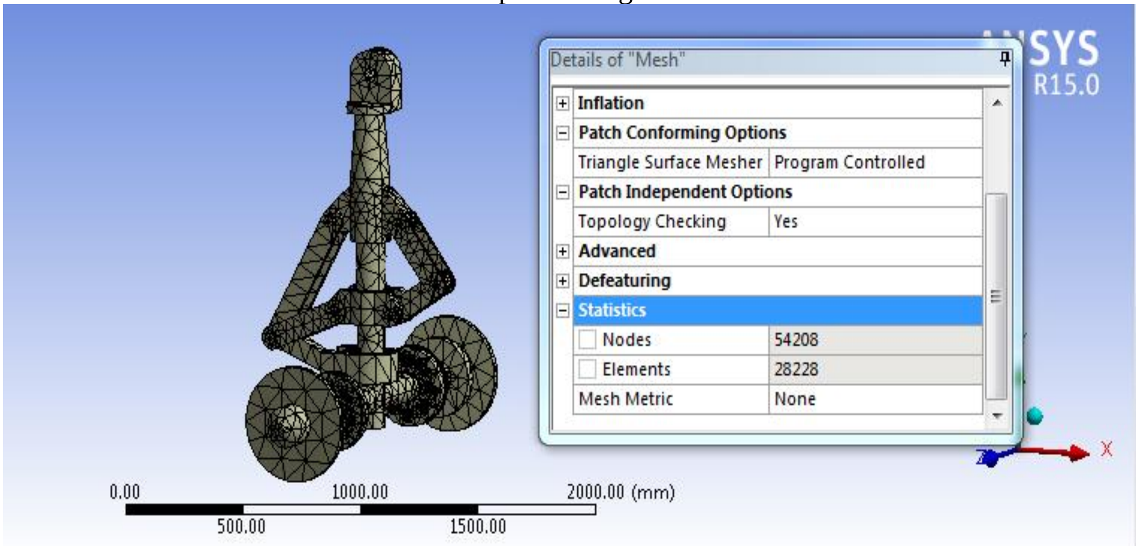


Figure 14. Mesh nodes: 54208 Elements: 28228.

Journal of Polymer & Composites
Volume 11, Special Issue 8
ISSN: 2321-2810 (Online), ISSN: 2321-8525 (Print)

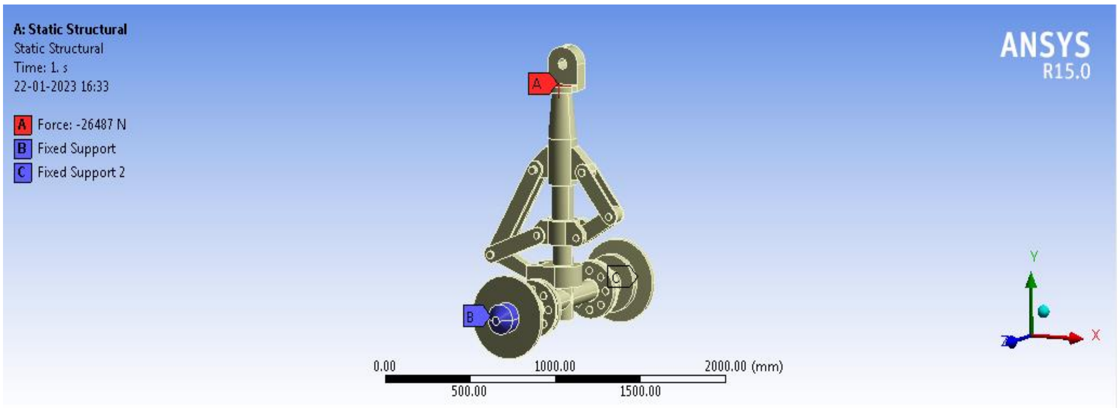


Figure 15. Boundary condition 26487N.

Conceptual Design 3

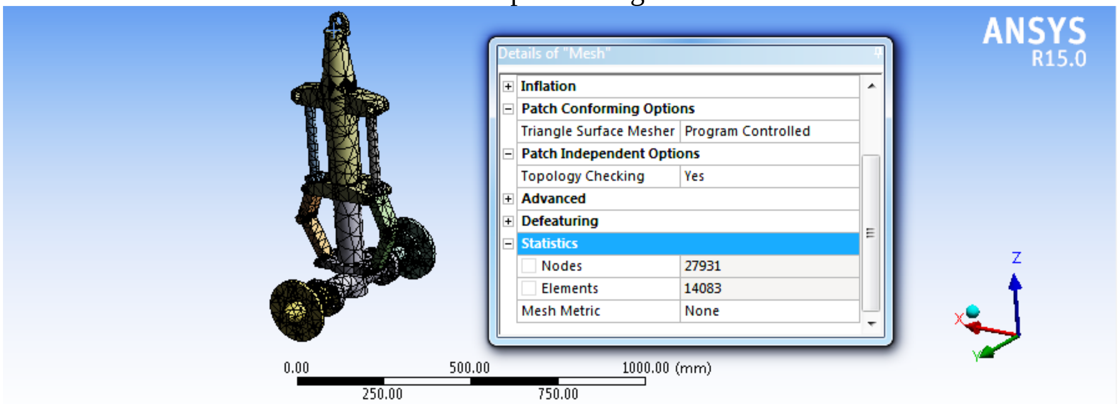


Figure 16. Mesh nodes:27931 elements: 14083.

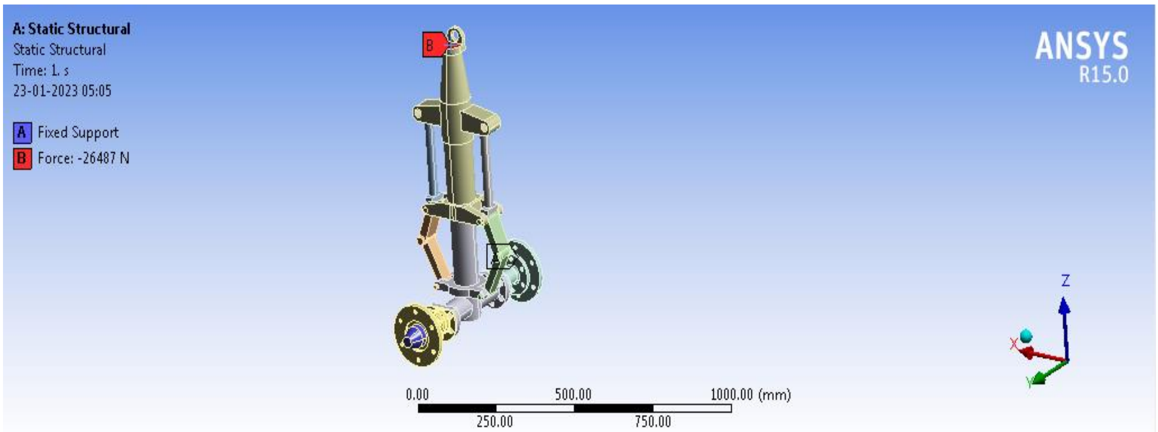


Figure 17. Boundary condition 26487N.

RESULTS AND DISCUSSIONS

The landing is designed in CATIA software and analysed in ANSYS. Using various materials, the von-misses stress, total deformation, shear stress, and strain were determined in static analysis. Ti6Al-6v-2sn, Ti10Al-2Fe-3V, Alloy steel 4340, Ti7Al4Mo, Ti6Al4V utilized.

MODEL 1 OF LANDING GEAR

The various model of landing gear is shown in below Figures 18–21.

Ti7Al4Mo Material Properties

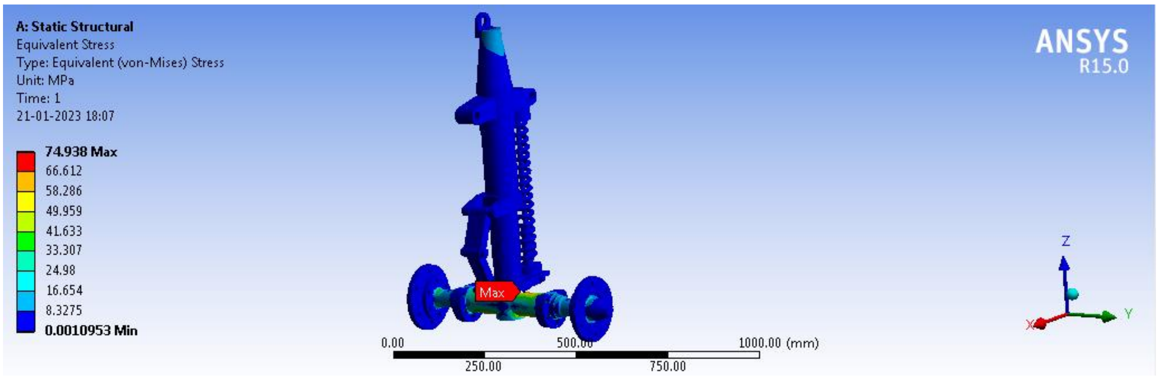


Figure 18. Von-misses stress of Ti7Al4Mo Material.

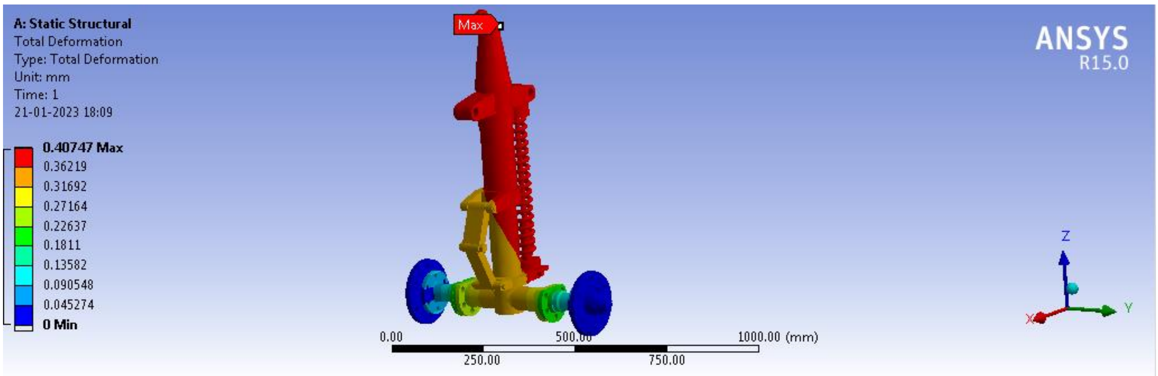


Figure 19. Total deformation of Ti7Al4Mo Material.

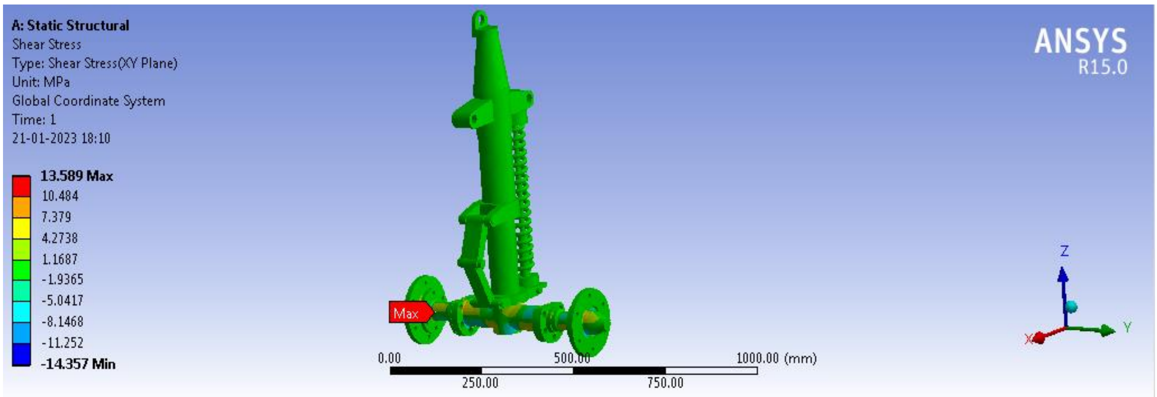


Figure 20. Shear stress of Ti7Al4Mo Material.

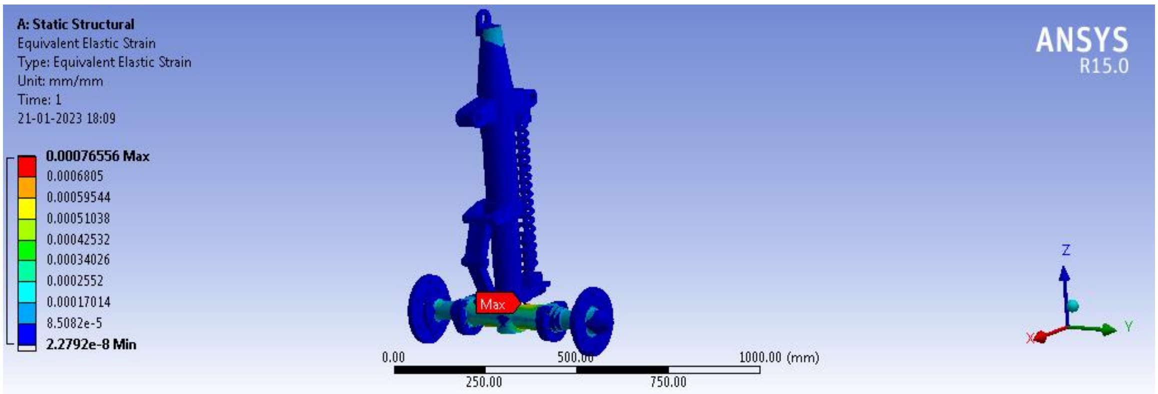


Figure 21. Strain of Ti7Al4Mo Material.

MODEL 2 OF LANDING GEAR

The different models of landing gear is shown in below Figures 22–25.

Ti7Al4Mo Material Properties

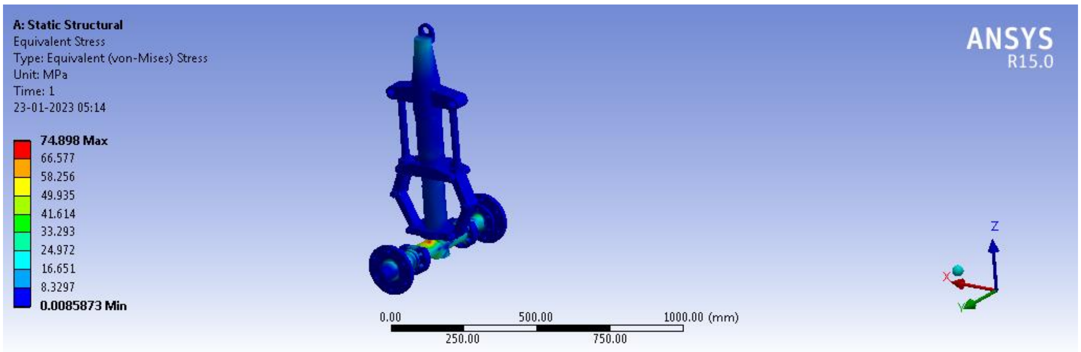


Figure 22. Von-misses stress of Ti7Al4Mo Material.

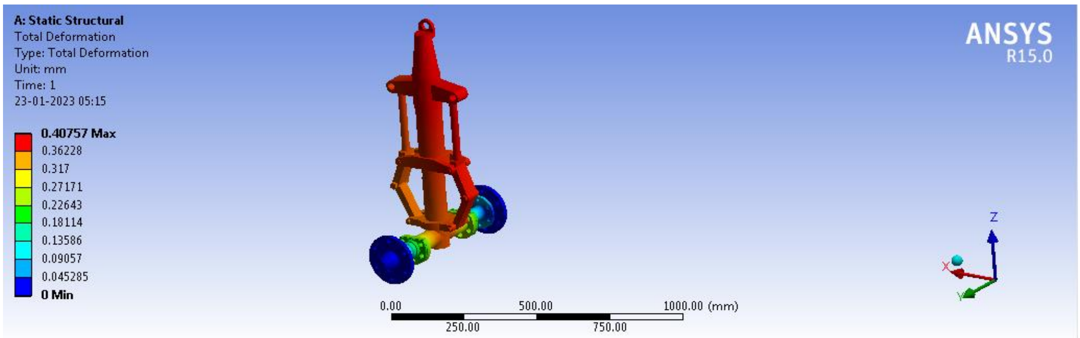


Figure 23. Total deformation of Ti7Al4Mo Material.

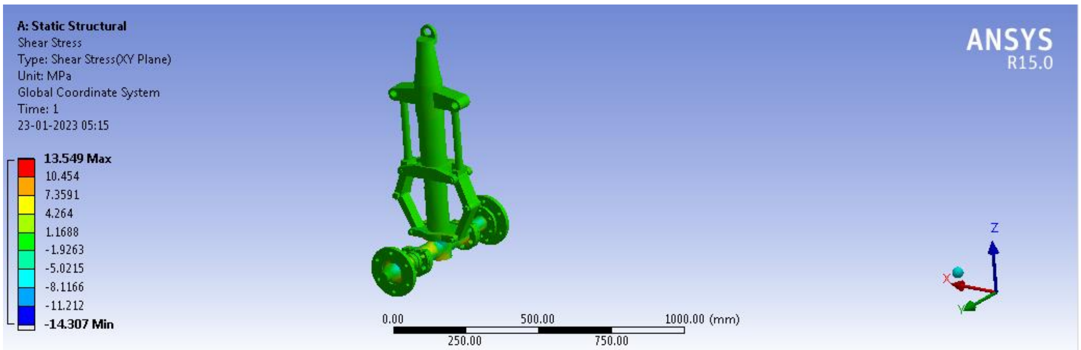


Figure 24. Shear stress of Ti7Al4Mo Material.

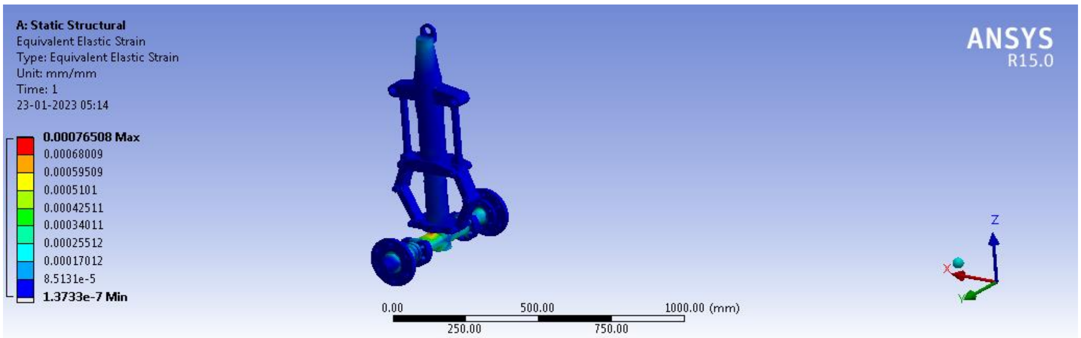


Figure 25. Strain of Ti7Al4Mo Material.

Ti7Al4Mo Material

The various models are shown in below Figures 26–29.

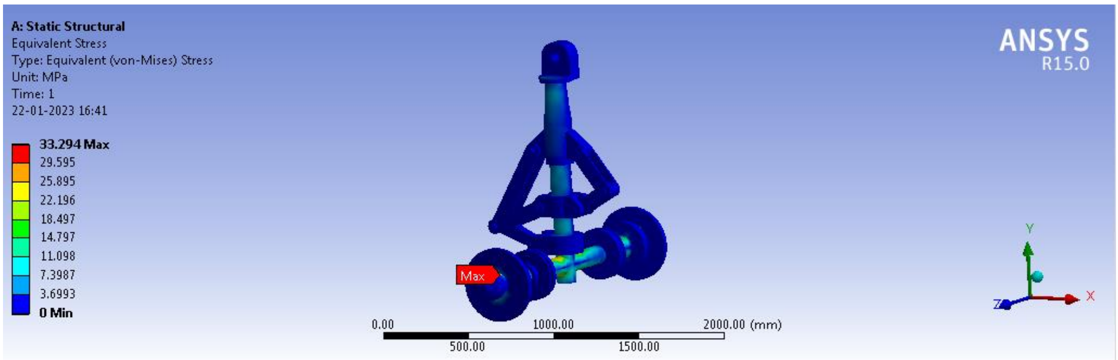


Figure 26. Von-misses stress of Ti7Al4Mo Material.

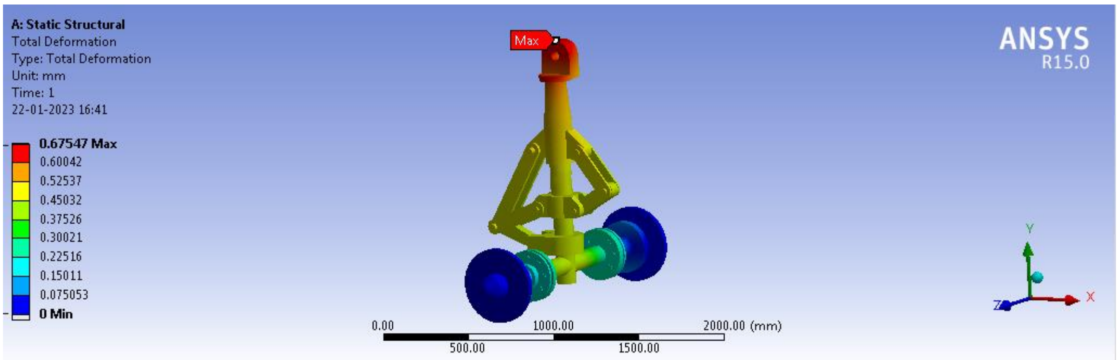


Figure 27. Total deformation of Ti7Al4Mo Material.

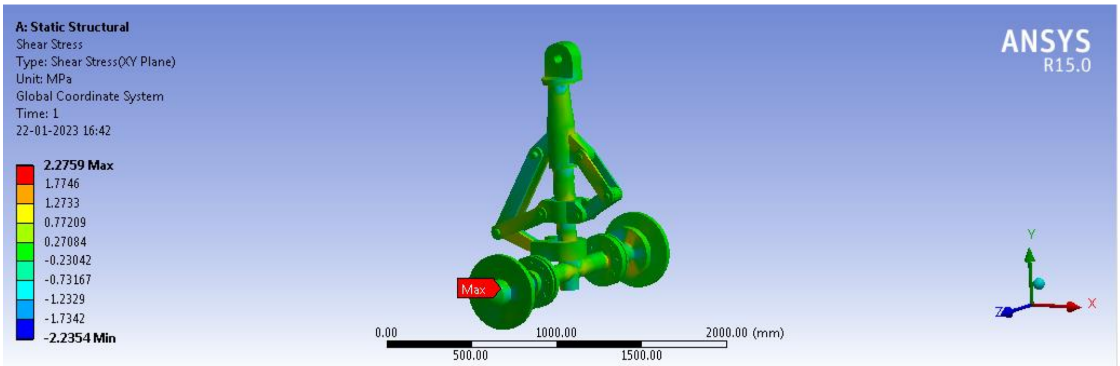


Figure 28. Shear stress of Ti7Al4Mo Material.

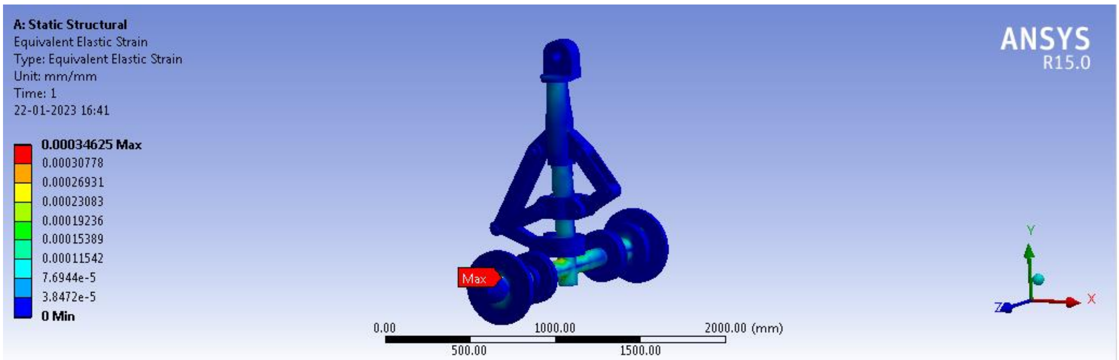


Figure 29. Strain of Ti7Al4Mo Material.

RESULTS TABLE

The simulation analysis of different designs-1, 2, 3 is shown in below Table 2–4.

Table 2. Simulation analysis of various materials for design-1.

Material	Von-Misses stress (Mpa)	Total deformation (mm)	Strain	Shear stress (Mpa)
Alloy steel 4340	75.187	0.22608	0.0004249	13.502
Ti6AL-6v-2sn	74.938	0.4296	0.000809	13.589
Til0Al-2Fe^{-3V}	74.875	0.43765	0.000822	13.589
Ti6Al4V	74.718	0.44	0.00098	13.768
Ti7AlMo	74.838	0.4074	0.000765	13.589

Table 3. Simulation analysis of various materials for design-2.

Material	Von-Misses stress (Mpa)	Total deformation (mm)	Strain	Shear stress (Mpa)
Alloy steel 4340	33.101	0.37312	0.0001912	2.4159
Ti6AL-6v-2sn	33.322	0.71038	0.000364	2.325
Til0Al-2Fe^{-3V}	33.562	0.7255	0.0003719	2.4212
Ti6Al4V	33.456	0.688	0.000352	2.321
Ti7AlMo	32.294	0.6754	0.000346	2.151

Table 4. Simulation analysis of various materials for design-3.

Material	Von-Misses stress (Mpa)	Total deformation (mm)	Strain	Shear stress (Mpa)
Alloy steel 4340	75.145	0.22618	0.0004246	13.481
Ti6AL-6v-2sn	74.898	0.4286	0.000804	13.549
Til0Al-2Fe^{-3V}	74.898	0.4377	0.000821	13.549
Ti6Al4V	74.679	0.4133	0.00077	13.727
Ti7AlMo	74.898	0.4075	0.000765	13.549

GRAPHS

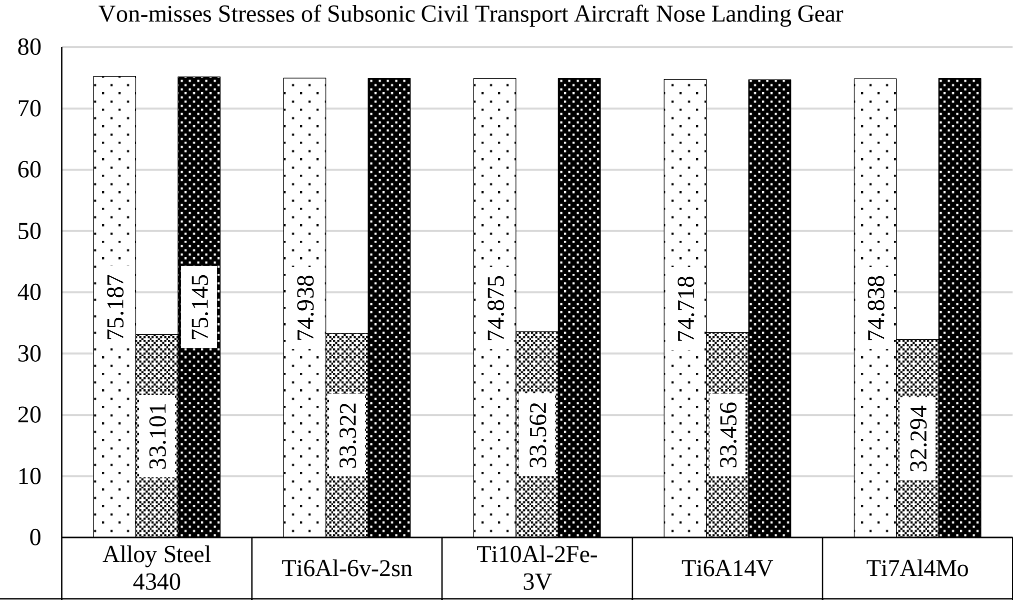
The equivalent (Von-Misses) stress, shear stress, total deformation, and strain are calculated using static structural analysis of various materials. These outcomes are graphically plotted and compared. With three different designs, the materials ALLOY STEEL 4340, Ti 6Al-6v-2sn, Ti10Al-2Fe-3V, Ti6Al4V, and Ti7Al4Mo are used in the design and static modal analysis. Von-Miss stress, shear stress, total deformation, and strain were all calculated. Finally, all designs and materials are compared and the results are graphically plotted.

VON-MISSES STRESS GRAPH

The nose landing gear of a subsonic civil transport aircraft is designed and statically analysed using various materials, including ALLOY STEEL 4340, Ti 6Al-6v-2sn, Ti10Al-2Fe-3V, Ti6Al4V, and Ti7Al4Mo [18, 19]. The suspension, brakes, shock absorbers, and other landing gear assembly components are all designed differently than the others. The Ti7Al4Mo material has less von-misses stress, as shown in the graph below Figure 30.

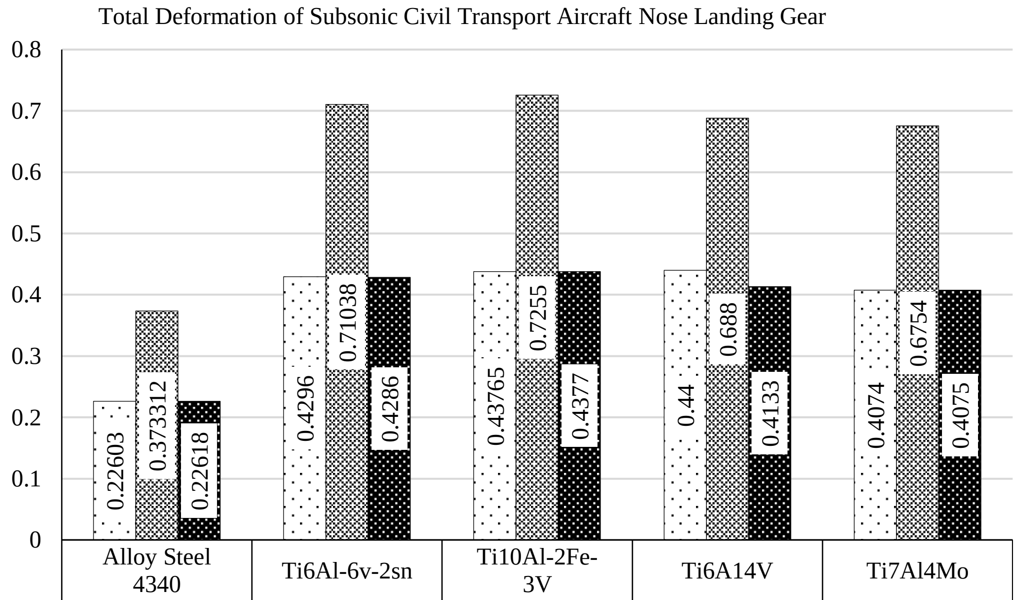
TOTAL DEFORMATION GRAPH

The nose landing gear of a subsonic civil transport aircraft is designed and statically analysed using a variety of materials. Ti 6Al-6v-2sn, Ti10Al-2Fe-3V, Ti6Al4V, and Ti7Al4Mo are all alloy steels. The landing apparatus In comparison to all designs, assembly of all parts, including suspension, brakes, shock absorbers, and other components, using various designs. The alloy steel 4340 material has less total deformation, as shown in the graph below Figure 31.



	Alloy Steel 4340	Ti6Al-6v-2sn	Ti10Al-2Fe-3V	Ti6A14V	Ti7Al4Mo
New Design 1	75.187	74.938	74.875	74.718	74.838
New Design 2	33.101	33.322	33.562	33.456	32.294
New Design 3	75.145	74.89	74.898	74.675	74.898

Figure 30. Von-misses stress graph.



	Alloy Steel 4340	Ti6Al-6v-2sn	Ti10Al-2Fe-3V	Ti6A14V	Ti7Al4Mo
New Design 1	0.22603	0.4296	0.43765	0.44	0.4074
New Design 2	0.373312	0.71038	0.7255	0.688	0.6754
New Design 3	0.22618	0.4286	0.4377	0.4133	0.4075

Figure 31. Total deformation graph.

SHEAR STRESS GRAPH

The nose landing gear of a subsonic civil transport aircraft is designed and statically analysed using a variety of materials. Ti 6Al-6v-2sn, Ti10Al-2Fe-3V, Ti6Al4V, and Ti7Al4Mo are all alloy steels. The landing apparatus In comparison to all designs, assembly of all parts, including suspension, brakes, shock absorbers, and other components, using various designs Shear stress is lower in design 2 Alloy Ti7Al4Mo 2.151 Mpa material, as shown in the graph below Figure 32.

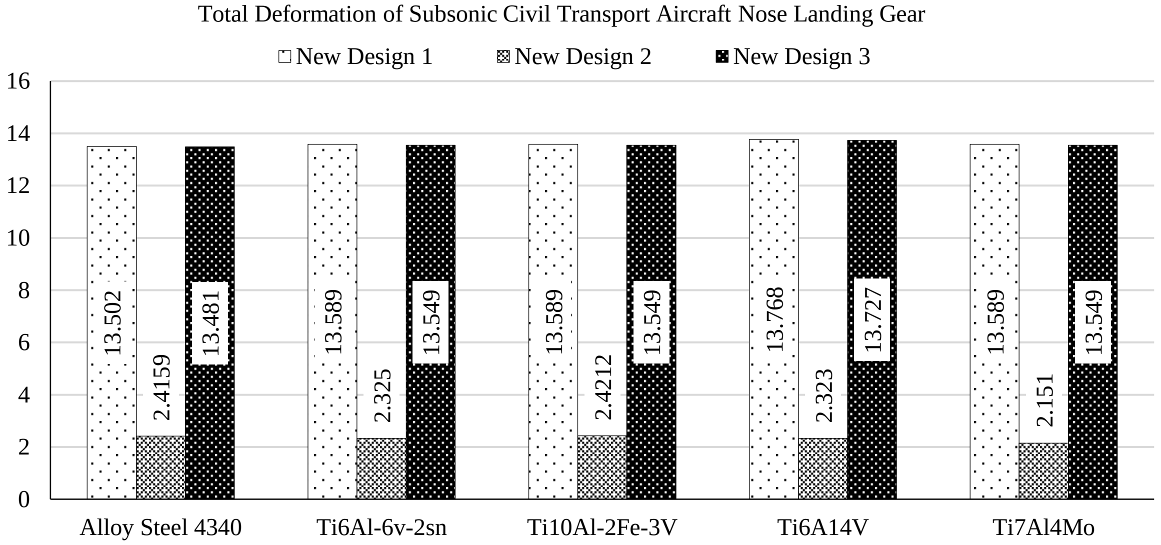


Figure 32. Shear stress graph.

STRAIN GRAPH

The nose landing gear of a subsonic civil transport aircraft is designed and statically analysed using various materials. Ti 6Al-6v-2sn, Ti10Al-2Fe-3V, Ti6Al4V, and Ti7Al4Mo are all alloy steels. The suspension, brakes, shock absorbers, and other parts of the landing gear assembly are all designed differently than the other designs. Design 2 Alloy steel 0.0001912 and Ti7Al4Mo 0.000346 material have Less Strain as shown below Figure 33.

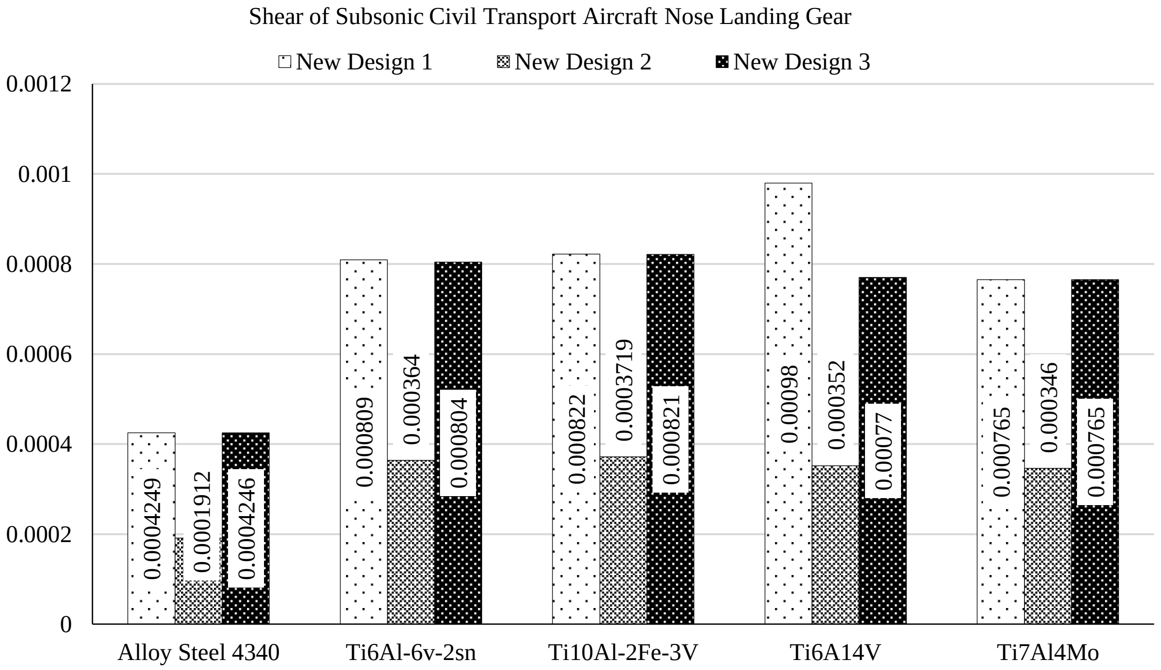


Figure 33. Graph of strain.

CONCLUSIONS

Typically, a landing gear system for an airplane must absorb the kinetic energy of a landing impact and stimuli brought on by the plane flying over an irregular landing surface. Design and analysis of landing gear using various materials like Ti 6Al-6v-2sn, Ti10Al-2Fe-3V, Alloy steel 4340, Ti7Al4Mo, and Ti6Al4V. The design process is done in catia V5 using a sketcher, part design, and assembly design. Perform the static analysis in Ansys software here to find out the von misses stress, strain, deformation, and shear stress using various designs and materials. IGS File is imported Ansys software performs the preprocessor, solution, and postprocessor. Performed the static analysis in Ansys software here find out the Total deformations at different frequencies. Compared to the graphical representation of various designs Ti7Al4Mo Material 2 modal Subsonic civil transport aircraft nose landing gear is designed and statically analyzed using various materials ALLOY STEEL 4340, Ti 6Al-6v-2sn, Ti10Al-2Fe-3V, Ti6Al4V, and Ti7Al4Mo. The suspension, brakes, shock absorbers and other parts of the landing gear assembly are all meant to be different than the other designs. As shown in the chart below, the Ti7Al4Mo material has less von-misses stress.

Subsonic civil transport aircraft nose landing gear is designed and statically analyzed using various materials ALLOY STEEL 4340, Ti 6Al-6v-2sn, Ti10Al-2Fe-3V, Ti6Al4V, and Ti7Al4Mo. The landing equipment Assembly of all parts, including suspension, brakes, shock absorbers, and other components, using various designs in contrast to all designs 1 Designing and Designing As shown in the graph below, the alloy metal 4340 material has less bending moment. Subsonic civil transport aircraft nose landing gear is designed and statically analyzed using various materials ALLOY STEEL 4340, Ti 6Al-6v-2sn, Ti10Al-2Fe-3V, Ti6Al4V, and Ti7Al4Mo. The landing equipment Assembly of all parts, including suspension, brakes, shock absorbers, and other components, using various designs in comparison to all designs As shown in the graph below, Design 2 Alloy Ti7Al4Mo 2.151 Mpa material has much less shear stress. Subsonic civil transport aircraft nose landing gear is designed and statically analysed using various materials ALLOY STEEL 4340, Ti 6Al-6v-2sn, Ti10Al-2Fe-3V, Ti6Al4V, and Ti7Al4Mo. The suspension, brakes, shock absorbers, and other sections of the landing gear assembly are all designed differently than the other designs. As shown in the graph below, design 2 alloy steel 0.0001912 and Ti7Al4Mo 0.000346 components have less strain. Finally concluded the Ti7Al4Mo Material has the best in modal analysis because of less total deformation while increasing the frequencies values. Finally Ti7al4Mo Material has the best material with 2 modal so this is concluded the further manufacturing models.

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