3-DIMENTIONAL IMPACT ANALYSIS OF GOLF CART CHASSIS

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Abstract -Chassis frame is the basic frame work of the automobile. It supports all the parts of the automobile attached to it. It is made of drop forged steel. All the parts related to automobiles are attached to it only. All the systems associated to automobile like power plant, transmission, steering and suspension, braking system etc., are attached to and supported by it only. For structural chassis cylindrical seamless pipe is been used having minimum of 0.18% of carbon the chassis is designed wide and long sufficient to effectively protect the drivers body in case of collision or rollovers. The ground clearance is about 110 mm from the ground.

Keywords - Chassis design, Strain &Impact displacement, Impact stress.

I. Introduction

The chassis is inherently important, as it is the frame, the internal structure that supports all the components and occupants of a golf cart, preferably in a well-balanced and effective manner. Rigidity in bending and torsion, efficient load absorption and low weight are key to strong chassis performance.

Space frame and monologue are currently the preferred chassis types for golf carts. A space frame chassis involves the assembly of components onto a skeleton-like structure of steel rods. The body provides minimal structural support. Monologue chassis, however, adapt an anybody approach, where the body is also the structure.

Today, weight and stiffness are perhaps the most important chassis design concerns. New materials are being experimented with and carbon fibre reinforced polymers are rapidly becoming a preferred option, thanks to their inherently strong stiffness, tensile properties and low weight

II. Literature review

The number of authors discussed about the chassis is the framework of any vehicle. The suspension, steering, and drive train components such as motor, controller, transmission, and final drive components are mounted to the chassis. In addition, the constructions of today are vehicles require the use of many different materials. Chassis of golf-cart is not much different from normal car chassis; in fact it is much less complicated. The different in size and weight make golf-cart chassis much easier to design and constructing. R. Patil et al [1] in his paper aims to model simulate and perform the static analysis of a go kart chassis consisting of Circular beams. Modelling, simulations and analysis are performed using modelling software i.e. Solid Works according to the rulebook provided by Indian Society of New Era Engineers (ISNEE) for National Golf cart Championship (NGKC-13).The

maximum deflection is determined by performing static analysis.

Vrushabh R. Rathod et al [2] whoaim to design, modal, stimulate and perform the static examination of an Eco-kart Chassis made up of Circular cross section pipes. Modelling and Analysis are performed using Software i.e. Creo2.0 and ANSYS 14.0 respectively according to the rulebook provided. The maximum deflection is determined by the stage static analysis with concern to position of motor and battery position, braking System, steering system, seat position and many more. The FEA results are verified by comparing with analytical calculations. Considering these results modal is modified.

Louis R. Richards et al [3] Asmall, lightweight, three-wheel two-passenger auto motive vehicle has a stiff, open main box frame of tubular steel formed by two spaced side rails joined by front and rear rails, with a motor mount frame extending forwardly from the main frame; a unitary, one-piece tub of moulded, glass. Be reinforced resin Ills most of the main frame opening and peripheral. Angels on the tub are resiliently mounted on the side rails of the main frame. The foundation of the tub extends below the side rails of the main frame, affording a sustain floor and side walls for a passenger compartment encompassed by the main frame and also providing a cover or support, or both, for such vehicle components as a hand brake lever, gear shift lever, fuel tank, transmission, etc.

Charles Lanius et al [4] A golf cart having an engine enclosure comprising a forward and a rearward clam shell, each pivotally connected to the cart chassis at their front and rear ends.A unitary, one-piece body shell of moulded, glass Bar reinforced resin is resiliently mounted on the tub and covers the exterior of the main frame; a unitary one piece? Bar glass hood is provided to complete the vehiclebody. A sealing gasket seals substantially the entire periphery of the tub to the body shell.

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Marvin H. Hartman et al [5] Hisequipment for converting a usual battery-poweredgolf bag Cart to a Vehicle for transporting a golfer- apparatus includes a frame engage able to the chassis of the cart. Such frame is configured to support a seat for supporting a golfer. Wheels are rotatable engaged to opposed ends [56] References Cited of an axleto the frame. Abstracted is to the frame for securing it to the chassis and for reinforcing the inter connections of the chassis to a frontal nose Wheel mount and to a rear Control handle.

Larry MI Cheng Journal et al [6] The present invention provides a chart chassis a front and a rear cart frameworks bridged together, While the releasing and assembling mechanism comprises a handle - bar, a turntable member and a joint assemble and handle bar to turn the turntable member outward's, and separating the joint assembly from the turntable member thereby performing instant detachment of the cart chassis.

III. Experimental setup

The commercial design software, solid works is used for the design and analysis of the golf cart chassis. The chassis frame is modelled with 2D-dimensional and 3D-dimensional.The chassis was modelled by cylindrical seamless pipes. The cylindrical seamlesspipes haveanouter diameter of34mm, inner diameter of 30mm and thickness of 4 mm. About 40 linear beam elements were used for the chassis. Load value of the chassis as per analysis is 110 kg. The raw material usedfor the chassis is mild steel AISI 1018. The using of auto cad model the design of the golf chassis has been done. This explains the clear sketch of the golf chassis. It has different angle view of projections and perspective. It shows the projections of top view, front view, side view and back view of the chassis.
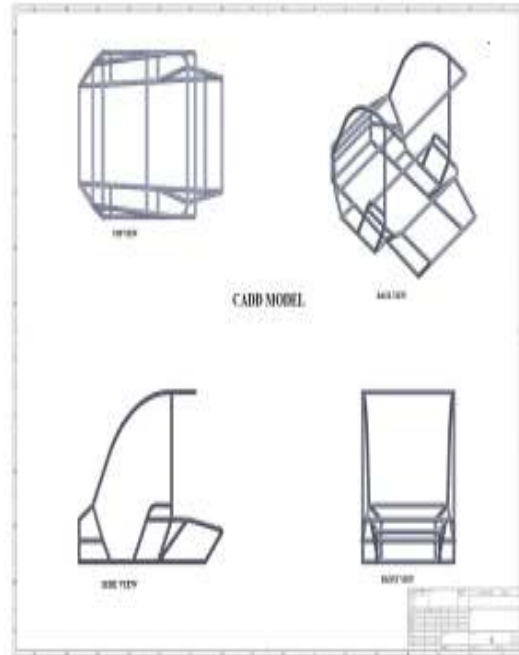

Fig.1Cad Model Layout

It helps to fabricate golf chassis from different angle view of projections. It makes chassis much easier to fabricate. Dimensions of chassis
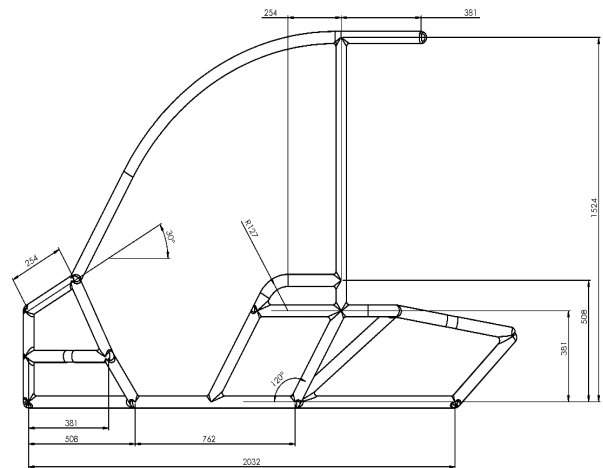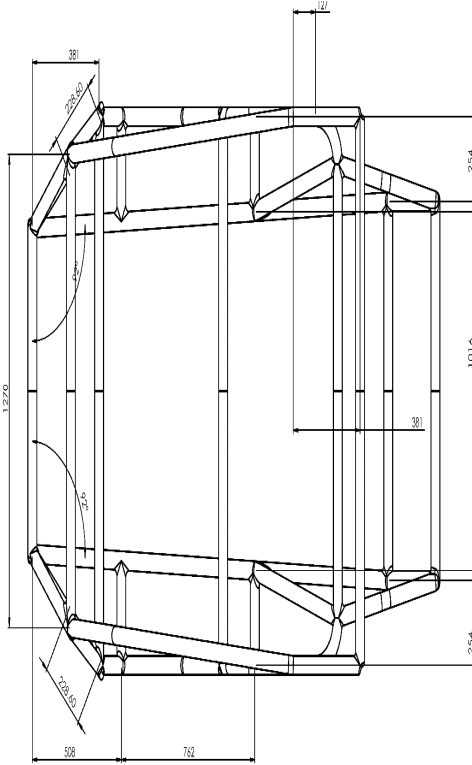

Fig 2 Dimensions of front view

Fig 3 Dimensions of top view

Table 1 Mechanical Properties of AISI 1018 steel

Properties	AISI 1018 Steel
Density (x 1000 kg/m^3)	7.7-8.03
Poisson Ratio	0.27-0.30
Elastic Modulus (GPa)	190-210
Elastic Modulus (GPa)	634
Yield Strength (Mpa)	386
Elongation (%)	27
Reduction in Area (%)	48

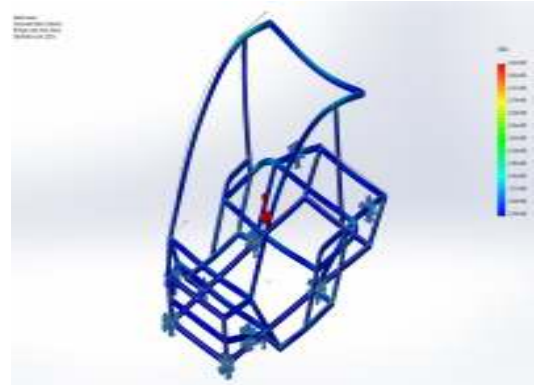**IV. Simulation and analysisStatic impact test 4d**

Fig 4 Static Impact Test

The impact strength of the material is the ability of the material to absorb shock and impact energy without breaking. The impact strength is calculated as the ratio of impact absorption to test specimen cross-section .Impact strength is the resistance of a material to fracture under dynamic load. It is a difficult characteristic which takes into explanation both the toughness and strength of a material. Impact strength is the ability of the material to absorb energy during deformation.

Analysis of strain displacement

Strain displacement is a measure of deformation representing the displacement between particles in the body of chassis.
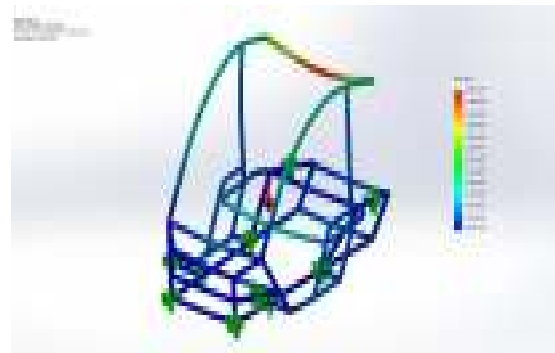

Fig 5 Analysis of Strain Displacement NOS:-3URES:-0.1950mm

The ratio of total deformation to the initial dimension of the material body in which the forces are being applied. Above the analysis of the strain displacement the number of safety is 3. This shows that it is minimum deflection of strain displacement of 0.1950 mm.

FRONT IMPACT AND DISPLACEMENT TEST 4G

Analysis of front impact strain

The front impact strain has been done which shows the ability strength of the material which would have shock absorb from front face. Which would be go any under

deformation. The material has be to taken account for their toughness and strength.

Fig 6 Analysis of front impact strain

This would have much strength act on body in front face. The material should absorb energy in any deformation in front face of chassis of the body. In which several load factors are considered.

Analysis of front impact displacement

Front impact displacement is todetermine the deformation representing the displacement between particles in the body of chassis. The ratio of total deformation to the initial dimension of the material body in which the forces are being applied. Above the analysis of the front impact displacement the number of safety is 3 is considered. This shows that it is minimum deflection of 0.3197 when body acts on 40mph. The front impact displacement has been too considered with loads and forces which going to be act on the body of chassis.
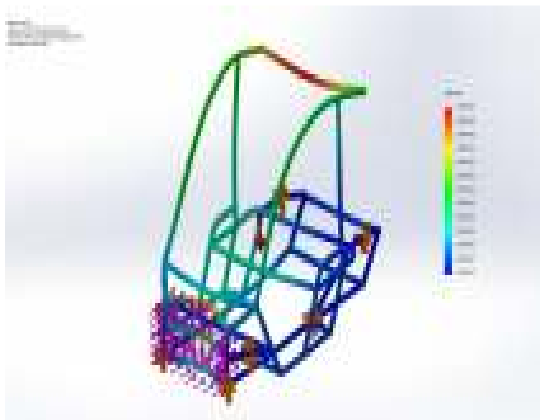

Fig 7 Analysis of front impact displacementNOS:-3URES:-0.3197 mm

Rear Impact, Displacement Test And Yield Strength 4d

Analysis of rear impact strain

The rear impact strain has been done which shows the ability strength of the material which would have shock absorb from back side. This would be going any under deformation. The material has been to taken account for

their toughness and strength. This would have much strength on the body the force is going act on the back side. The material should absorb energy in any deformation in back side of chassis of the body. In which several load factors and forces are going to act are considered.
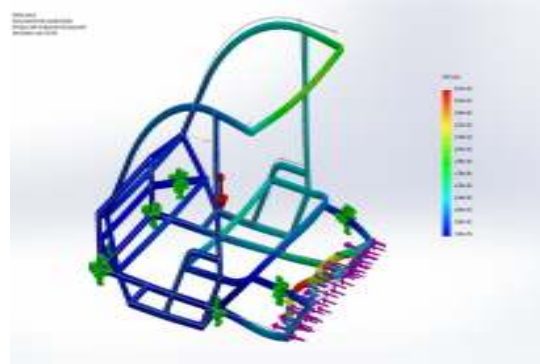

Fig 8 Analysis of rear impact strain

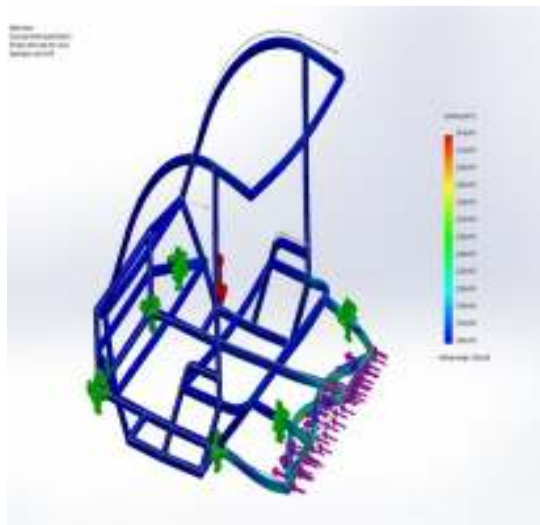**Analysis Of Rear Impact Displacement**

Fig9 Analysis of rear impact displacement

Front impact displacement is to calculate the deformation representing the displacement between particles in the body of chassis. The ratio of total deformation to the initial dimension of the material body in which the forces are being applied. Above the analysis of the front impact displacement the number of safety is 3 is considered. This shows that it is minimum deflection. When body acts on 40mph. The front impact displacement has been too considered with loads and forces which going to be act on the body of chassis. Rear impact of displacement of the material is the transformation in the geometry created when stress is applied (as a result of applied forces, gravitational fields, accelerations, thermal expansion, etc.).

Analysis of Rear Impact Yield Strength

Yield strength is to measure the permanent deformation in the materials. Yield strength is to measure of deformation representing the displacement between particles in the body of chassis. The chassis of the material is the change in geometry created when stress is applied (as a result of applied forces, gravitational fields, accelerations, thermal expansion, etc.).

Deformation is expressed by the displacement field of the material. The ratio of total deformation to the initial dimension of the material body in which the forces are being applied. Above the analysis of the front impact displacement the number of safety is 3 is considered.
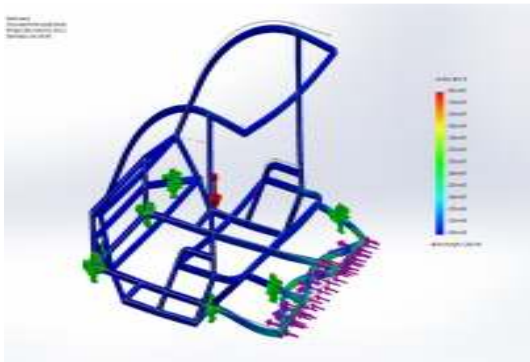

Fig 10 Analysis of rear impact yield strengthNOS:-3URES:-0.4176mm

This shows that it is permanent deflection of 0.4176mm when body acts on 40mph. The rear impact strain has be too considered with loads and force which going to be act on the body of chassis.

side impact, displacement and yield strength test 3d

Analysis of side impact strain

The side impact strain has been done which shows the ability strength of the material which would have shock absorb from both sides. This would be going any under deformation. The material has been to taken account for their toughness and strength. This would have much strength on the body the force is going act on the sides of the chassis. The material should absorb energy in any deformation in both sides of chassis of the body.
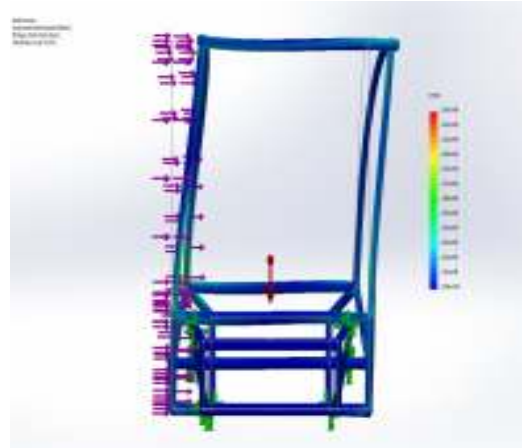

Fig 11 Analysis of side impact strain

In which several load factors and forces are going to act are considered.

Analysis of Side Impact Displacement

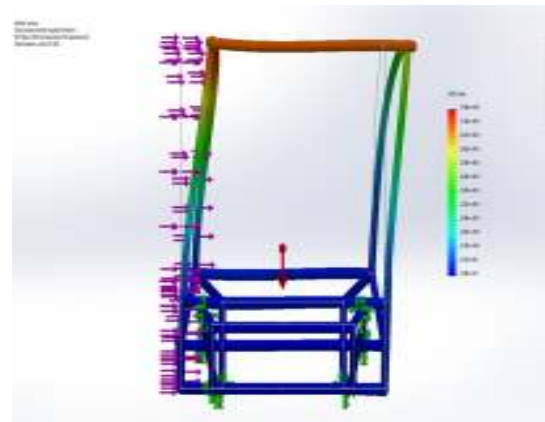

Fig12Analysis of side impact displacement

Side impact displacement is todetermine the deformation which represents the displacement between particles in the body of chassis. Therelation of total deformation to the initial dimension of the material body in which the forces are being applied. Above the analysis of the side impact displacement the number of safety is 3 is considered. This shows that it is minimum deflection. The side impact displacement has been too considered with loads and forces which going to be act on the body of chassis. Side impact of dislocation of the material is the change in geometry created when stress is applied (as a result of applied forces, gravitational fields, accelerations, thermal expansion, etc.).
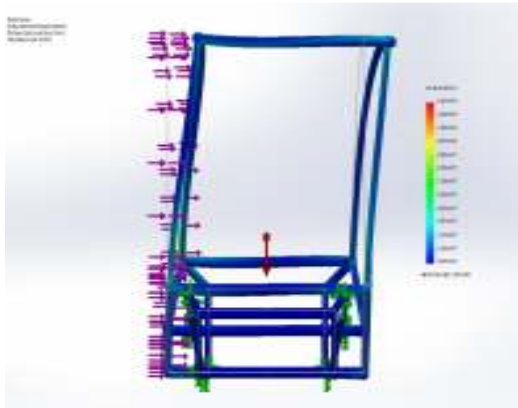
Analysis of Side Impact Yield Strength

Fig 13 Analysis of side impact yield strengthNOS:-3URES:-7.4949 mm

Yield strength is to measure the permanent deformation in the materials. Yield strength is to measure of deformation representing the displacement between particles in the body of chassis. The chassis of the material is the change in geometry created when stress is applied (as a result of applied forces, gravitational fields, accelerations, thermal expansion, etc.). Deformation is expressed by the displacement field of the material. The ratio of total deformation to the initial dimension of the material body in which the forces are being applied. Above the analysis of the front impact displacement the number of safety is 3 is considered. This shows that it is permanent deflection of 7.494mm when body acts on 40mph. The rear impact strains have been too considered with loads and force which going to be act on the body of chassis.

The chassis is the central element of the golf cart and how it performs is thus of great significance. All components are fond of to the chassis, and it is subjected to a variety of loads. The weight of the chassis and the manner in which it absorbs and transfers these loads play a significant role in its performance. Understanding the reason and performance requirements of the chassis gives direction to the design phase and forms a basis for innovative design approaches. Above the analysis and simulation of the chassis has been done. This shows the following results of the analysis.

(i)   Analysis of strain displacement is 0.1950mm

(ii)   Analysis of rear impact yield strength is 0.4176 mm

(iii)   Analysis of side impact yield strength is 7.4949 mm

V. Conclusion

The aim of the project was to provide with useful in orderto concerning material choices and guidelines for efficient chassis design and manufacture. These areas were researched on in depth through the course of this project and the findings have been summarized in this section. Chassis rigidity is important to enable the adjustment of conduct while competing, but with high torsional stiffness comes high weight. Due to the satisfactory material properties of carbon fibre, a composite chassis has proven to easily fulfil the stiffness requirements. The most important thing is to focus on other factors, such as the manufacturability and cost of the chassis.

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