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Design and Crash Analysis of a Go-kart Chassis Using Finite Element Analysis

Vemulakonda Vinay¹, G.Siva Sai²

P.G. Student, Department of Mechanical Engineering, Gonna Institute of Information Technology & Sciences,
Visakhapatnam, India¹

Assistant Professor, Department of Mechanical Engineering, Gonna Institute of Information Technology & Sciences,
Visakhapatnam, India²

ABSTRACT: In The Present Study Report Crash Analysis of Go-kart Is Design And Simulate for Various impact tests like front impact test, rear impact test and side impact test for four materials. Firstly Design of Chassis Was Done in CAD Software (Catia V5 R21), and Simulate in ANSYS 19.2 Workbench. This paper constitutes designing and Failure criterion of Go-Kart Chassis with four different materials according to Von-Mises Stress. The main Theme of Present Study, Analysis Is to perform the various impact test cases like front and side impact and Secondly to Enhance the Safety Factor of the Passenger. Finally designing of new frame with less deformation comparatively. In this analysis We had Carried Out range of forces Values for the impact. For the Present Analysis strength Of Material, Structural Rigidity and Various Engineering Processes are Main Deliberations .

KEYWORDS: Go-Kart, FEA analysis, CATIA, ANSYS.

I. INTRODUCTION

Chassis is a frame that plays a major role in automotive industry in which the entire engine, body of a frame mounts on it. There are two major groups one is running gear and the other one is power plant. The frame, Steering system, brakes, wheel and tyres comes under running gear. The power plant includes the power, engine transmission assemblies. Basically Go- Kart was mounted with a small engine or May me run using batteries which can carry up to 2 passengers. it was also considered as a light weight vehicle when compared to the other vehicles. Go-kart chassis should be manufactured strong enough to withstand various vibrations and variable loading conditions and should constitute good tensile and compressive properties

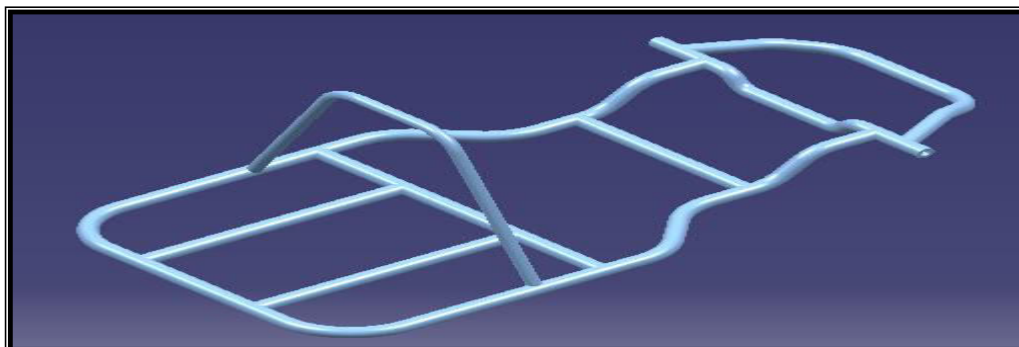


fig.1 shows the basic design of chassis frame

fig 1 show the basic design of the chassis frame of the single passenger carrier. it was comparatively cost reductive than the normal automotive and strength is based on the material we had used for the chasses manufacturing. Common materials used for fabrication of chassis are structural steel .aluminium and alloy metals. The ultimate concept is to withstand the chassis under various deformations, stresses and sudden loads.

Paper is organized as follows. Section II describes related info about Wheel rim, section III lists out various materials and manufacturing processes for wheel rim whereas section IV presents the experimental results and section V presents conclusion.



II. RELATED INFORMATION

The chassis as shown it was a frame work of the vehicle in which the engine and the power transmission components are mounted on it. From the prior experiments it was known as that the longer vehicle wheel base are much smoother and stronger than the short wheel base which intern increases the stability of the vehicle and sudden shocks that experienced by the vehicle. There are many people who show interest on Go- karting in all over the world. They can even drive fast which actually depends on engine specifications and there need to be a proficient driver. The go-kart came into existence in the year 1950s and most common go kart are the one which has no suspension and differential for the simple Go-kart. Later on with respect to the present era of modern automotive techniques it was fabricated similar to four wheeler car. Due to the lower ground clearance from the chassis frame to the wheel base it is less chance of dangerous accidents and that can be easily controlled and maintenance of go- kart is very low compared to the other motor vehicles in automotive industry

There are main criterions in which the fabrication of chassis is made of different material depending upon the load and passenger capacity and the type of engine or battery used to go-kart and also the track to run.

This study was motivated by a necessity for a comparative study crash test made on aluminium chassis which are a number of the mostly used materials to manufacture the Chassis. It had been desired to develop an optimized geometry, material, and manufacturing procedure, which can reduce the burden for fuel efficiency. However, the view of study for Go-Kart, the specified procedures used may be modified and implemented for go-kart from other styles of Motor vehicles.

III. MATERIALS AND MANUFACTURING PROCESSES

The frame that supports the entire weight i.e. engine assemblies and steering and other components so the chassis frame must be strong enough to with hold the weight imposed on the chassis frame. for this study and analysis we have used the aluminium for the entire fabrication of the chassis. Comparing the performance of those materials with relevance cyclic, static and impact loading are of great interest to the automotive industry. The selection of material for chassis frame plays a major role or the vehicle proving the reliability, safety, and endurance limits. The chassis frame material selected depending upon the various material properties hardness, strength, weld ability and machining.

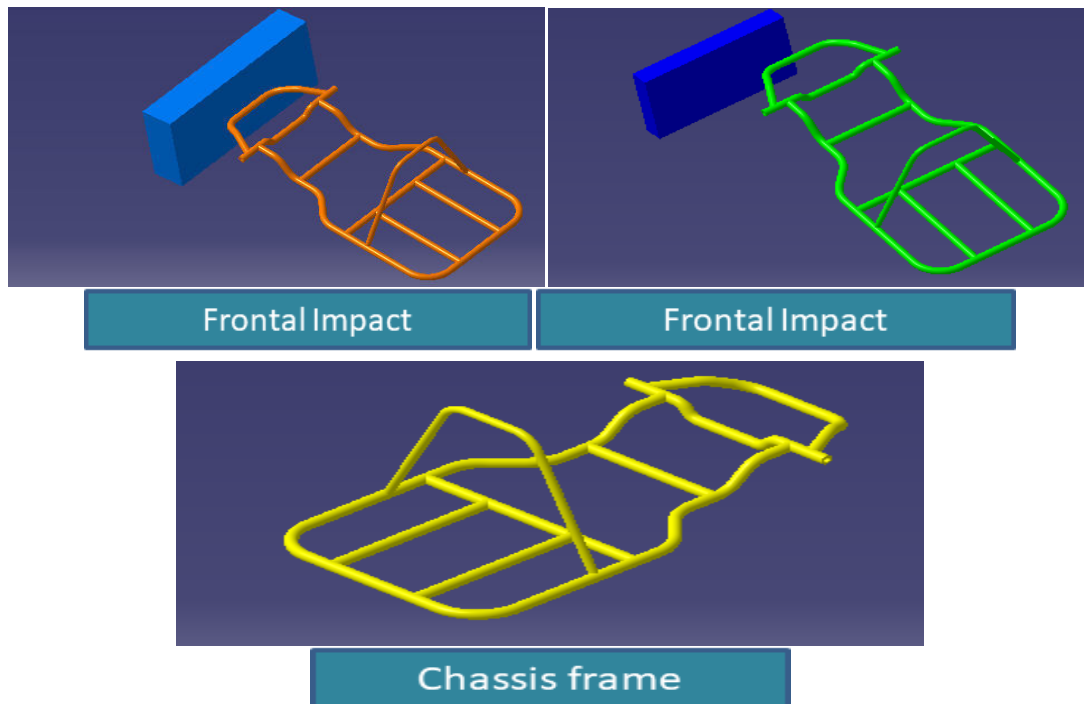
Material type	Poissons Ratio	Youngs Modulud	Density	Bulk Modulus	Shear modulus
Aluminium	0.33	7.1E+10 pa	2770 kg ⁻³	6.9608E+10 pa	2.669E+10 pa

Table.1Shows thematerial properties of Aluminium

IV. MODELING AND ANALYSIS

In this study cad models are used to identify the best design which is based on stress values and fatigue life. Previously geometry construction and editing techniques are used to create the model. These techniques create the models of wire frame and surfaces that could be edited by a geometric editing, however, these systems had no Capability to understand the relations between the geometry. Later parametric modeling systems were introduced, which could be used to build relationships between geometric entities and parameters.

Modeling of the Go-Kart is done using CATIA. CATIA is one of the powerful modeling software package which is one of the most effective parametric modeling and surface feature based modeling software. Solid modeling is carried out in CATIA which has a rich set of features and parameters to create and modify the designs. In this paper solid wheel rim is considered for the analysis



The procedure followed in Catia for designing the solid chassis frame is as follows; Initially getting the 2D Sketch which is the profile of the web Then taking the guide curve to show the path to the rib option select the profile and the guide curve to make a solid. this procedure is as follows by taking different plane positions to create the entire solid chassis and perform shell to chassis of required dimensions. care should be taken while performing the takes. The model in CAT PART and as well as IGES format IGES file format for meshing purpose. IGES means Initial Graphic Exchange Specification, this file can be easily imported to any software package. The CATIA part file can also be saved as STEP file.

The basis of FEA is segregation or decomposition of the components to the finite number to elements in order to make the problem easy. This function making of domain to finite number of elements is called as interpolation functions which are referred as nodes.

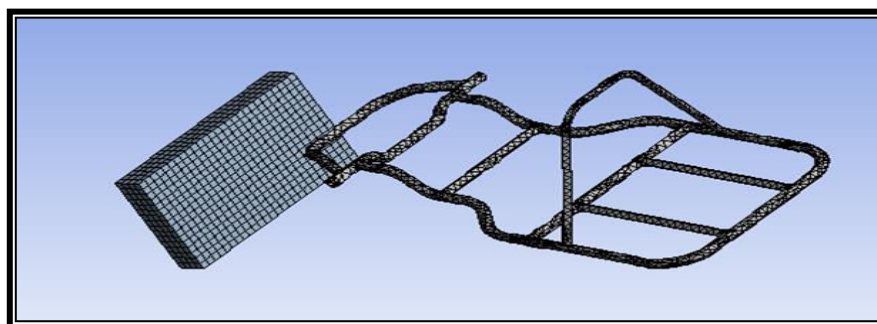


Fig 2.Represents the Meshing of Chassis

ANSYS is a Finite Element Analysis (FEA) software package. Finite Element Analysis is a numerical method of deconstructing a complex system into very small pieces called elements. The software implements equations that constitute the behaviour of these elements and solves them all; The ANSYS Workbench environment is an intuitive up-front finite element analysis tool that is used in conjunction with CAD systems .ANSYS Workbench is a software environment for performing Various analysis i.e structural, thermal, and electromagnetic analyses. The Workbench focuses on attaching existing geometry, setting up the finite element model, solving, and reviewing Experimental results.



V. LOADING AND BOUNDARY CONDITION

In a go kart The chasses frame experiences variable Stresses under different loading conditions. The boundary conditions are given with respect to the newly created polar co-ordinate system. These boundary conditions are given in ANSYS software to the model using Boundary Condition option which constrains all degrees of freedom except in radial direction (theta constraint). The rotations are constrained as the solid model does not have the rotational degrees of freedom (DOF).

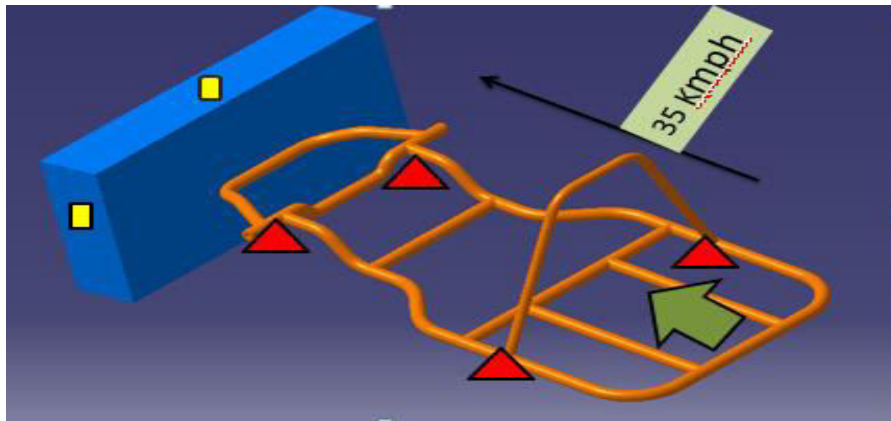


Fig3. Shows the Chassis frame moving with a velocity

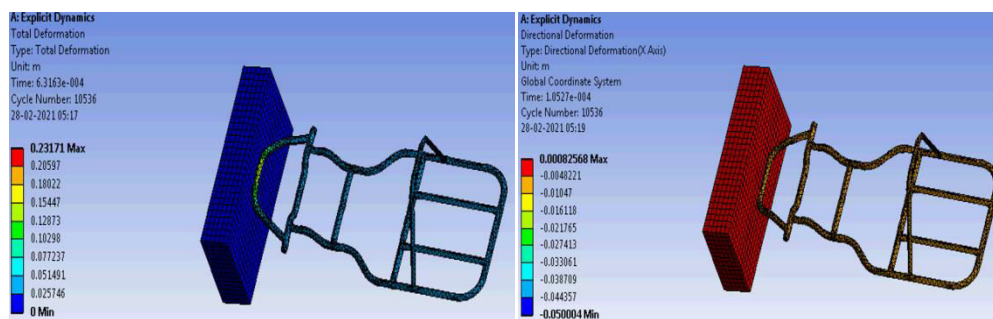
V. RESULTS AND DISCUSSION

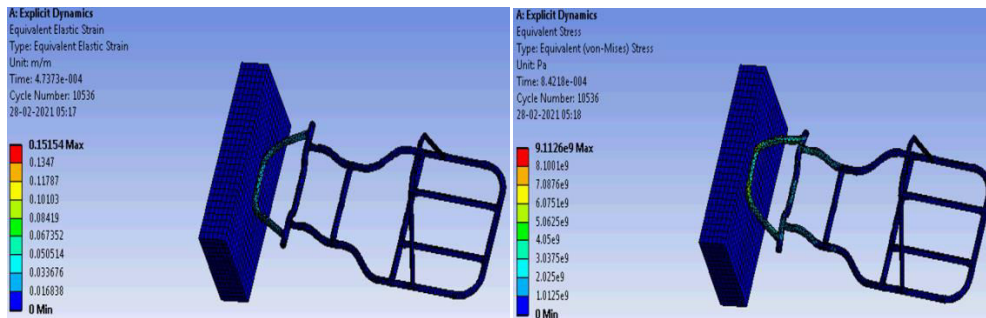
On the basis of evaluated results total deformation, Equivalent stress, equivalent strain, Directional deformation is as follows

Type of loading	Total deformation	Directional Deformation	Equivalent strain	Equivalent stress
Front impact load	0.23171	0.00082568	0.15154	9.1126e9
Side impact load	0.11054	0.010573	1.2718	5.2896e+10

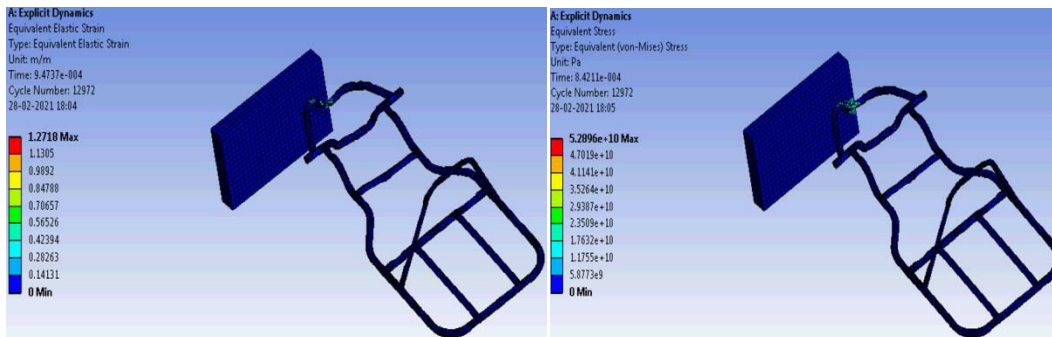
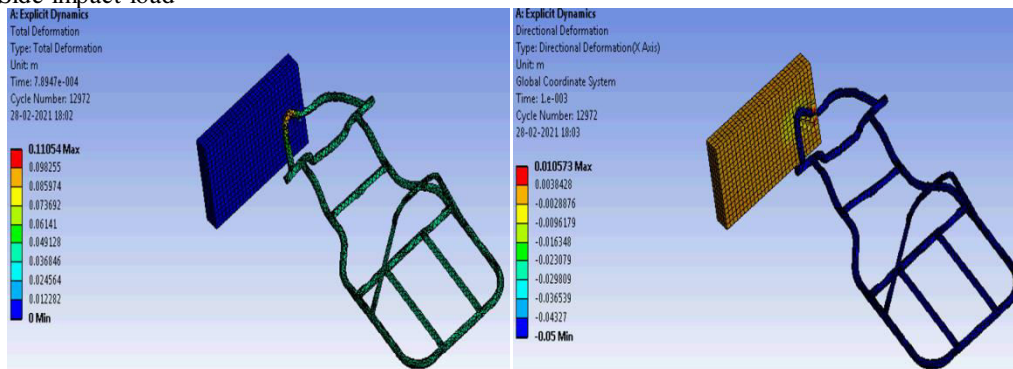
Table2.project the maximum values of deformations, stresses and strain

Results for front impact load

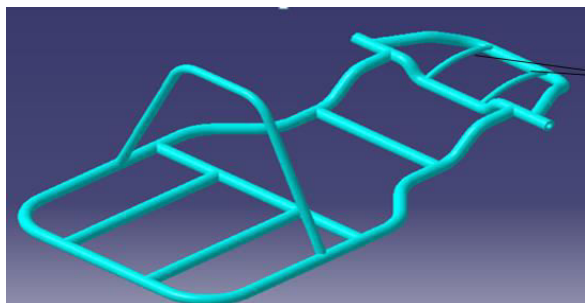




Results for Side impact load



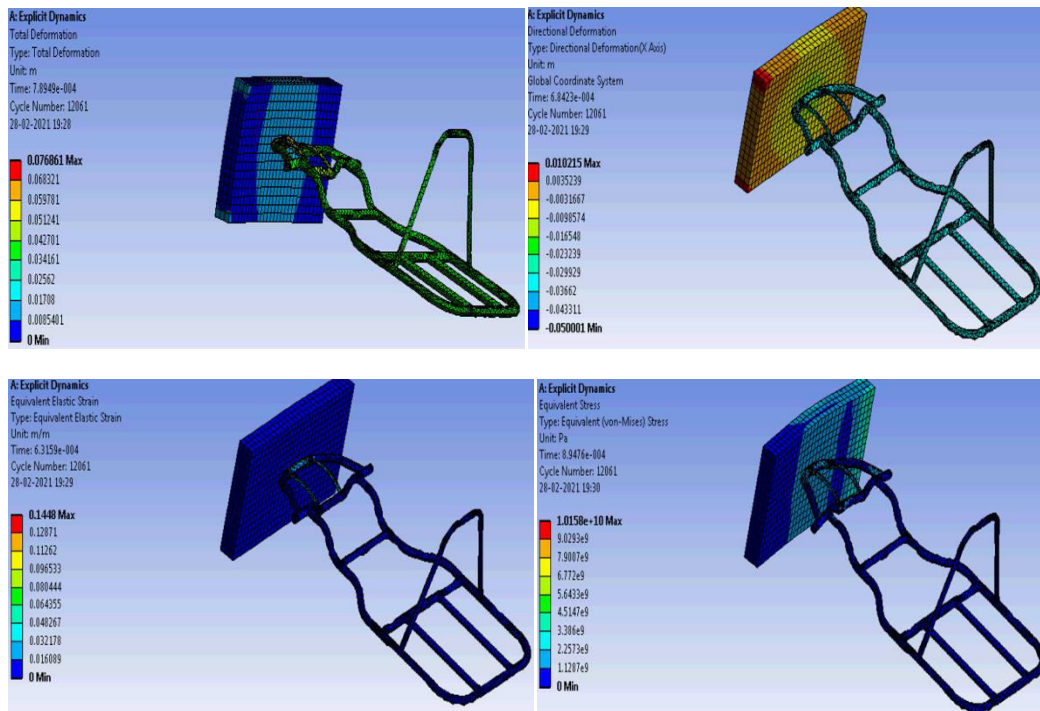
New Design



Experimental results

Ribs added to the front bumper to increase the strength

Fig4 .show the new model



V. CONCLUSION

The Maximum Deformation Obtained at the frontal bar of the chassis bar evenly. And the maximum stress appears at the corners of the chassis. The value of von-misses stresses that comes out from the analysis is far less than material yield stress so our all three design is safeBased on the obtained results with help of shape optimization improve the dynamic characteristic of base design. The Maximum Deformation Occurs at the front side and side of the chassis from the results. With the help of ribs to the new design we have reduced the deformation rate with a Minimal. The overall analysis is carried out with a velocity of 50m/s both in front and side impacts test as well as the optimized Design.

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