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Design, analysis and manufacturing of GO-KART chassis

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ABSTRACT

The key objective of this project is to manufacture the most reliable Chassis for the Go-kart keeping all the constraints in consideration. The following are the constraints which were very keen before starting the design process, 1.We wanted the design to be as compact as possible basing the track limitations in the rounds like Autocross and Skid-pad where in, the a kart needs to be driven in very narrow paths. However we need to be sure with Driver's ergonomics is our top priority while designing every single part in the vehicle, 2. The overall length and width of the chassis was based on the wheelbase and track width measurements obtained from steering calculations., 3. Members in the chassis are placed based on the Placement of the major components like Engine, Driver seat, Steering system, transmission, Etc. Material plays an important role for improving the performance of chassis.It is essential to design the behavior of the chassis structure. The objective of the present investigation aims to get perfect material for the chassis and strong material to withstand the various loads offered by the vehicle and which has good machinability and weldability too. After performing research on all the options available in the market, We have selected AISI 4130 as the material for manufacturing our chassis. After calculations with different materials and properties for chassis We have selected AISI 4130 is best for manufacturing the chassis. AISI 4130 steel is a chromium-molybdenum alloy steel and is considered a low carbon steel. Even though it has high carbon content,it has a superior hardened ability than other iron alloys. The chassis of a GO-KART consists of a body frame made up of steel pipes that are welded together.
By looking at all the properties,We have opted that TIG welding produces cleaner and more precise welds than other weldings and also a finite process that has more factors to play. Because welding in the form of lap fillet joints is mainly used in manufacturing chassis and fatigue strength is the most important property requirement for welded joints. The primary objective is to design a safe and functional vehicle based on a rigid and torsion free frame. This design is chosen such that the cart is easy to fabricate in every possible manner.This report explains about the objectives, assumptions and calculations made in designing for chassis

KEYWORDS: *Modes shapes, Reliability, Strength of materials, 4 Ease to manufacture, 5 Structural rigidity, Low ground clearance, ANSYS workbench*

1. INTRODUCTION

A GO-KART is a 4- non-aligned wheel vehicle without suspension that is mainly used in sports for racing purposes & for recreation.
GO-KART is a land vehicle with or without bodywork with non-aligned wheels in contact with the ground,

two which control the steering while the other two transmit the power.

Fig 1.1 GO-KART

The term CHASSIS can be described as the frame which supports all the components of the vehicle.

DIMENSIONAL SPECIFICATIONS

Front Track width	900 mm
Rear Base	1000 mm
Wheel Base	1000 mm
Ground Clearance	25.4 mm
Overall Length	1780 mm
Overall Width	1300 mm

The wheels of the vehicle are mounted on the chassis with the help of king pin and sprockets and the other parts are also attached with bolts and welding process.

The chassis should be rigid from all the Bending and Torsion stress. To ensure the safety of the driver the chassis should be designed to comply with basic safety rules and at the same time serve its purpose.

FIG 1.4 STUDENTS GO-KART CHAMPIONSHIP (SKDC)

The chassis of a GO-KART consists of a body frame made up of steel pipes that are welded together. There are a lot of sports available to people for their entertainment & motor sports is one of them. Mostly to drive bikes, cars and F-1 one must have professionalism But what if there would be a motor sport where there is no need to have professionalism in driving i.e. GO-KART, which does not need professional drivers & has low speed .

The main focus is on producing lower cost and light weight vehicle structure but with better safety efficiency.

Various parameters of GO- KART can be altered in order to improve the competitiveness for other motor racing.

There are different sub-parts of the design of GO-KART.

1. Chassis Department
2. Steering Department
3. Brakes and Tire Department

Out of these, chassis departments are the important one as the chassis frame –provides the necessary support to the vehicle component placed in it. Hence this frame should be strong enough in order to withstand all the vibrations to make the GO-KART more efficient in terms of its performance.

Every machine vibration because of the repeating forces acting on it and resonance.

The prime concern is to produce light weight vehicles at low cost .However due to light chassis frame the chassis frame will not be able to sustain the vibrations caused by the dynamic forces by the engine, road irregularities and all the other loads.

Hence this can affect the safety & stability of the GO-KART, computer based analysis techniques like finite element analysis is an important subject to design.

In the present investigation four materials AISI 1018, AISI 1026, AISI 1020 and AISI 4130 are selected Based on the strength and physical properties of that material , it is used to make analysis in ANSYS.

Problem Statement

The problem statement of this project is:

To improve the skill and knowledge of Mechanical engineering students in designing and importance of project developing go-kart.

The cost of the current go-kart chassis is too expensive

Objective

The objectives are as follows:

To design a go-kart chassis.

To fabricate a go-kart chassis.

Scope

The scopes of the project are as follows:

Create conceptual design by using solid works.

Chassis design should bear a load of 185kg.

2. DESIGN AND ANALYSIS

The design process of the single person go-kart is iterative and is basically based on several engineering and reverse engineering processes. The top priority of this design was to keep the frame of the chassis as light as possible. The weight of the vehicle is a major factor in vehicle performance when the power of the vehicle is limited.

The chassis frame is one of the heaviest components of the go-kart

Design Methodology

The primary objective of the frame is to provide a 3-dimensional protected space around the driver that will keep the driver safe.

Its secondary objectives are to provide reliable mounting locations for components, be appealing, low in cost, and low in weight.

These objectives were met by choosing a frame material that has good strength and also weighs less giving us an advantage in weight reduction.

A low cost frame was provided through material selection and incorporating more continuous members with bends rather than a collection of members welded together to reduce manufacturing costs.

The design and development process of the roll cage involves various factors; namely material selection, frame design, crosssection determination and finite element analysis.

One of the key design decisions of our frame that greatly increases the safety, reliability and performance in any automobile design is material selection.

To ensure that the optimal material is chosen, extensive research was carried out and compared with materials from multiple categories.

The key categories for comparison were strength, weight, and cost. Here we are going to design the chassis for the material 4130 Chrome moly steel.

Major points that were considered for designing the following gokart:

Endurance

Safety and Ergonomics

Market availability

Cost of components

Standardization and serviceability

Safe engineering practices

The frame is designed to meet the technical requirements of competition; the objective of the chassis is to encapsulate all components of the kart, including a driver, efficiently and safely.

Driver Ergonomics and Safety

The ergonomics of the driver are designed in such a way to keep the driver in a comfortable zone and having the ability to perform a quick escape (within 5 Seconds) from the kart during a fire accident.

The seat design of the Go-kart is a bucket model, which accompanies a single person in the vehicle.

This Contour shape of the seat helps to keep the driver safe during the sudden turns of vehicle.

Safety is arguably the most important in any aspect of our lives. We designed the vehicle keeping safety our top most priority. A fire extinguisher is placed in our kart with regards to the rules of SKDC. We also provided a kill switch.

Principal aspects of the chassis focused on during the design and implementation included driver safety, drivetrain integration, and structural weight, and operator ergonomics.

The number one priority in the chassis design was driver safety. By the competition rules and Finite Element Analysis (FEA), the design is assured.

We proceeded by setting up the budget for the project. Throughout the design process we distributed the budget in such a way that if we assign more money to one system, then we reduce that amount from the other system.

CAD Design

1.Round tubing pipe of outer diameter = 1” 2.Thickness of pipe = 2 mm

2. Material used AISI 4130

3. Designing : solidworks software

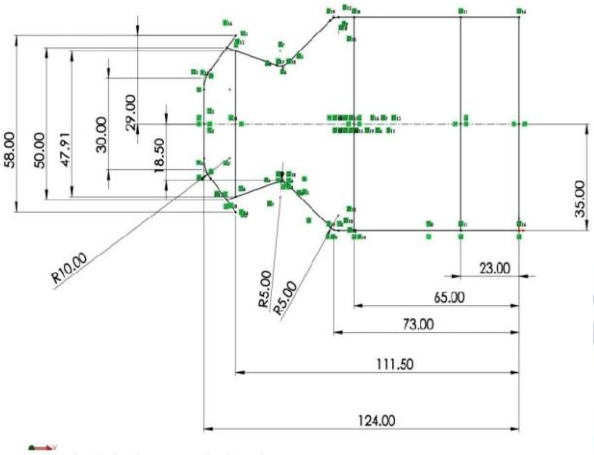
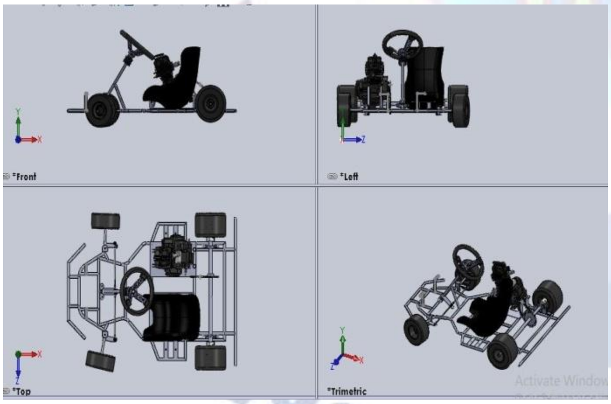


FIG 2.3.1 Members arranged in Dimensions

TABLE : Technical Specifications

Parameter	value
Wheel base	1000 mm
Vehicle track	Front =900 mm Back =1000 mm
Tube dimensions	1”
Roll cage materials	AISI 4130
Roll cage mass	15 KG

Fully developed CAD views



Material Selection

One of the key design decisions of our frame that greatly increases the safety, reliability and performance in any automobile design is material selection.

To ensure that the optimal material is chosen, extensive research was carried out and compared with materials from multiple categories. The key categories for comparison were strength, weight, and cost.

In general in the design of mini all terrain vehicles, if the standard tube size of 1”x0.12” is not used, then the material has to have equivalent bending strength to that of 4130 steel in the standard tube size.

While the rules set many factors of the material’s geometry, there are many other limitations.

These limitations include the method of fabrication and industry standards for the material. The frame will be built using a bent tube construction and MIG welded joints.

MIG welding becomes difficult at wall thicknesses less than 0.035 inches. The tubing bender that will be used for the fabrication can bend a maximum of 1.5 inch diameter tube with a 0.120 inch wall thickness.

The geometry is also limited by industry standards. It is important to utilize commonly available tubing sizes and materials. Tubing is available in standard fractional sizes to the 1/8th of an inch: 1, 1.125, 1.25, 1.375, and 1.5. The wall thickness is limited to: 0.035, 0.049, 0.058, 0.065, and 0.083 inches.

Cost, availability, weight, strength & weld ability are the four key factors which determine the material selection. Tubing is available in standard fractional l sizes to the 1/8th of an inch: 1, 1.12, 1.25 and 1.5.

The wall thickness is limited to the common Birmingham Tubing Gauges. In this case these are: 1.5, 1.8, 2, 2.5 and 3 mm. The most commonly available materials are:

TABLE: MECHANICAL PROPERTIES

Materials	Yield strength (MPa)	Percentage elongation of break
AISI 1026	260-440	17-27%
AISI 4130	435-979	18-26%
AISI 1020	230-370	18-28%
AISI 1028	270-400	18-29%

The chassis material is considered depending upon the various factors such as maximum load capacity, absorption force capacity, strength, rigidity.

TABLE : Chemical compositions of AISI 1018

Iron (Fe)	98.8 to 99.25%
Manganese(Mn)	0.6 to 0.9%
Carbon ©	0.15 to 0.2%
Sulfur (S)	0 to 0.050%
Phosphorus (P)	0 to 0.040%

TABLE Physical Properties Of AISI 1018

PROPERTIES	AISI 1018
Density	7.9 g/cm^3
Elastic (young's modulus,Tensile) modulus	210 Gpa
Elongation at Break	16 to 27%
Poisson's ratio	0.3
Tensile strength : ultimate strength	430 Mpa
Yield strength	264 Mpa
Thermal conductivity	51.9 W/m-k

It is observed that material which has high machinability and inexpensive is AISI 1018

AISI 1018 has excellent weldability and produces a uniform and harder case and it is considered as the best steel for carburizing parts. The 1018 carbon steel offers a good balance of toughness, strength and ductility.

TABLE: Chemical composition of AISI 4130

Iron (Fe)	97.03-98.22
Carbon C	0.28-0.3
Manganese	0.4-0.6
silicon	0.15-0.30
sulphur	0.01-0.04
Phosphorous	0.01-0.034

TABLE: Physical Properties of AISI 4130

PROPERTIES	VALUES
Tensile strength ,ultimate	580MPa
Tensile strength ,yield	460 MPa
Bulk modulus	140 GPa
Shear modulus	80 GPa
Modulus of rigidity	190-205 GPa
Poisson's ratio	0.27-0.3
Elongation at the break	21.50%

The material AISI 4130 is used in the frame design because of its good weld ability, relatively soft and strengthened as well as good manufacturability.

A good strength material is important in a roll cage because the roll cage needs to absorb as much energy as possible to prevent the roll cage material from fracturing at the time of high impact.

AISI 4130 was chosen for the chassis because it has structural properties that provide a low weight to strength ratio.

1 inch diameter tube with a thicker wall 2mm used for tubing instead of 1.5 inch diameter tube with a thinner wall for manufacturability purposes.

Thinner wall requires being welded using TIG (Tungsten inert gas) welding process which also makes it stronger and efficient to weld.

Although the thinner wall, 1.5 inch diameter tube would be slightly lighter than the thicker wall, it would have been more material and more difficult to weld. Then it is also assured by analysis in ANSYS software.

The above mentioned properties satisfy the technical requirement of

material which is to be used in frame.

Analysis

Ansys develops and markets engineering simulation software for use across the product life cycle.

Ansys Mechanical finite element analysis software is used to simulate computer models of structures, electronics, or machine components for analyzing strength, toughness, elasticity, temperature distribution, electromagnetism, fluid flow, and other attributes.

Ansys is used to determine how a product will function with different

specifications, without building test products or conducting crash tests. For example, Ansys software may simulate how a bridge will best process salmon in a cannery to reduce waste, or how to design a slide that uses less material without sacrificing safety.

Most Ansys simulations are performed using the Ansys Workbench

system,which is one of the company's main products.

Typically Ansys users break down larger structures into small components that are each modeled and tested individually.

A user may start by defining the dimensions of an object, and then adding weight, pressure, temperature and other physical properties.

Finally, the Ansys software simulates and analyzes movement, fatigue, fractures, fluid flow, temperature distribution, electromagnetic efficiency and other effects over time.

Finite Element Analysis After finalizing the frame along with its material and cross section, it is very essential to test the rigidity and strength of the frame under severe conditions.

The frame should be able to withstand the impact, torsion, roll over conditions and provide utmost safety to the driver without undergoing much deformation.

The solution of a general continuum by the finite element method always follows an orderly step by step process.

Step. 1. Discretization of structural domain

Step 2. Selection of a proper interpolation model

Step 3. Derivations of element stiffness matrices (Characteristic matrices) and load vectors.

Step4. Assemblage of element equations to obtain the overall equilibrium equation.

Step 5: Solution of system equations to find nodal values of the displacements (field variable)

Step 6: Computation of element strains & stresses from the known model displacements.

Analysis was conducted by use of finite element analysis FEA on ANSYS software.

Create mesh which splits the domain into a discrete number of elements for which the solutions can be calculated.

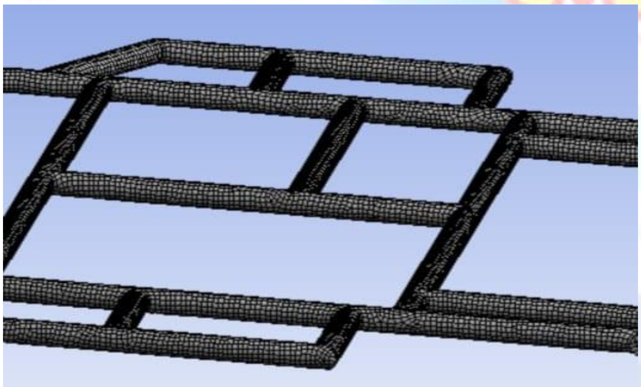


Fig 2.7.1 Meshing for chassis

To conduct finite element analysis of the chassis an existing design of chassis was uploaded from the computer stresses were calculated by simulating three different induced load cases .

Structural integrity of the frame was verified by comparing the analysis result with the standard values of the material.

Theoretically, calculated loads were placed on a wireframe model of the frame at critical points to simulate the amount of force that the vehicle would undergo from its own weight and the driver in the event of collision.

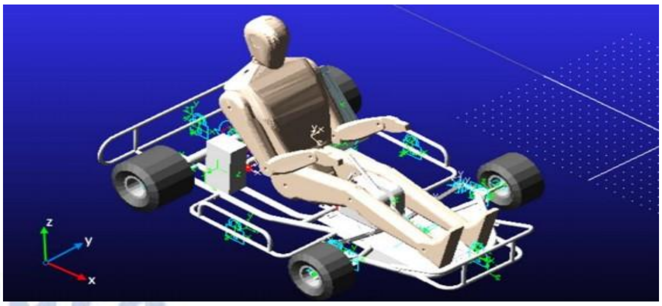


Fig 2.7.2 Analysis of the Go-Kart Chassis

Structure, after designing must be validated to know its reliability. Conventionally in FEA, the frame is subdivided into elements. Nodes are placed where tubes of frame join.

The assumption made in using beam elements is that the welded tubes have stiffness in bending and torsion, thus a higher factor of safety is desirable.

Static Analysis

Static program analysis is the analysis of computer software that is performed without actually executing programs.

This will simulate and perform the static analysis of a go kart chassis consisting of Circular beams.

Modeling, simulations and analysis are performed using modeling software i.e. Solid Works according to the maximum deflection is determined by performing static analysis

Front Impact test:

Generally in the case of pure elastic collision in frontal impact the linear velocity remains constant at 55 kmph

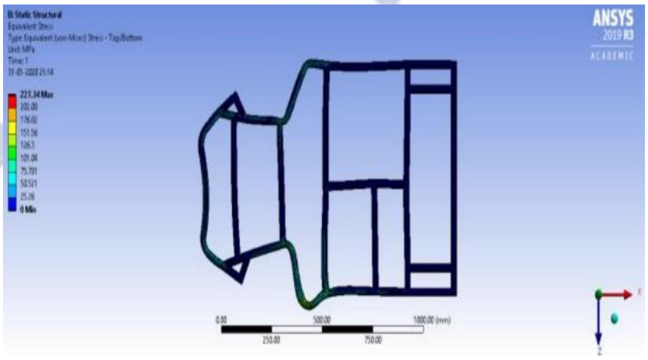
F=M*A

M=160KG

V=15.2 m/s or 55kmph A= V/t

A=15.2/0.3 = 50.6 m/s^2

Maximum stress in front impact =227.34 MPA



FOS =Yield strength /maximum stress

FOS =460/227.35 = 2.02

Total deformation in front impact test = 1.2 mm

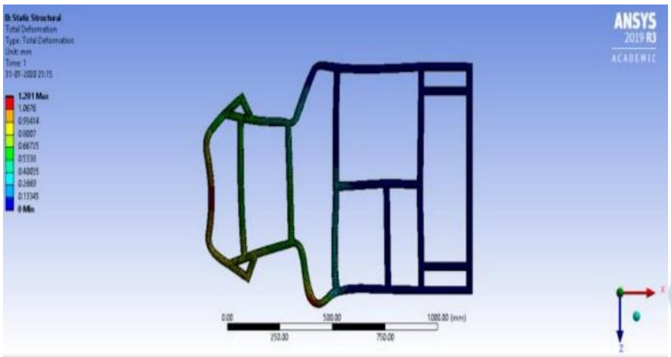


Fig 2.8.1 Front impact test

Rear impact test:

The rear impact force is also calculated in the same way . In this case the velocity of collision was 69 kmph or 19m/s by the calculations .

The simulated behaviour of the designed chassis in rear impact condition in terms of stress, displacement, safety factor as shown in Figure

According to the ANSYS standards .The calculations are asThe analysis result is shown below.

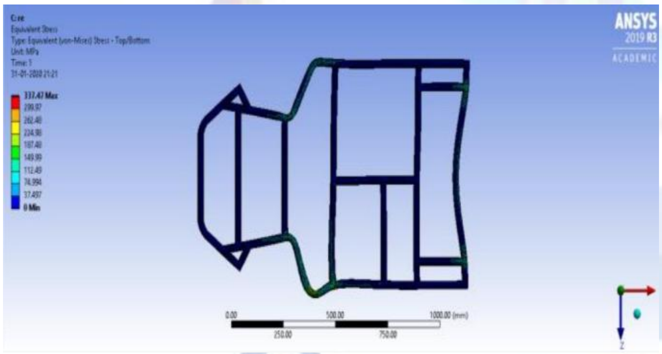
F=MxA

M=160KG

V=19.1 m/s A=v/t

A=19.4/0.5 = 38.8

F=160 x 38.8 F =6208N



Maximum stress in rear impact = 337.47 MPA Fos = yield strength/maximum stress

Fos = 460/337.47 Fos = 1.3

Total deformation in rear impact test = 2.31 mm

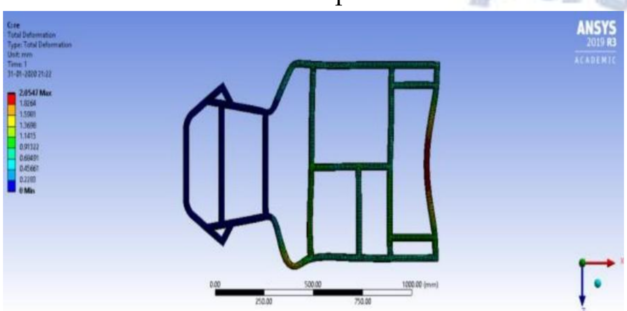


Fig 2.8.2 Rear impact test

Side impact test:

In the case of collision by side impact the value of the impact force generated is calculated in the same way as in front impact. For the side impact the velocity of the vehicle is taken 16.3 m/s or 59 kmph according to Standard .

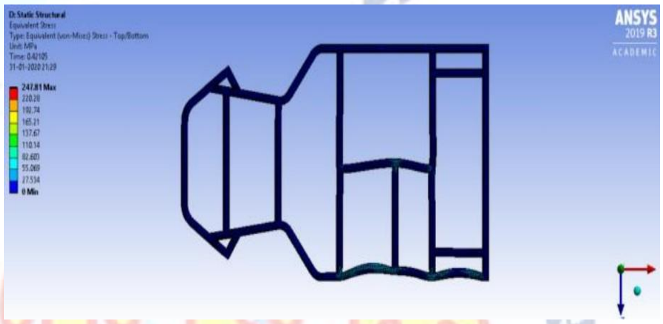
F=MxA

M=160KG

V=16.3m/s

A=v/t =16.6/0.3 = 33.2 m/s^2 F=160x50.6

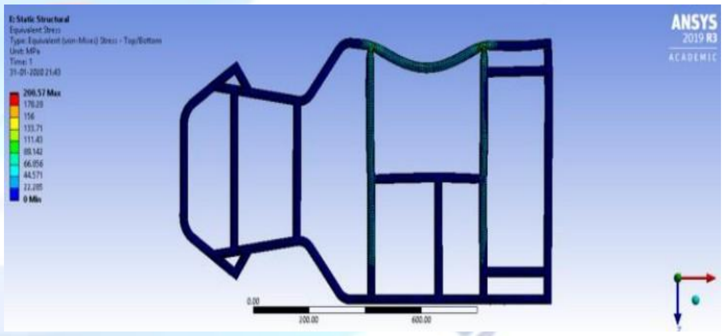
F= 8096N



Left

Maximum stress in side impact = 247.8 MPA FOS = Yield strength / Maximum stress

FOS = 460/247.8 = 1.8

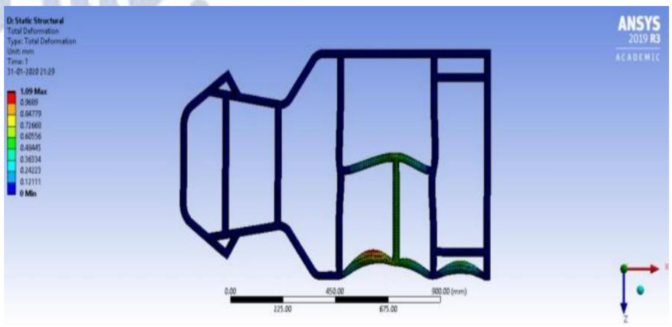


Right

Maximum stress in side impact =200.57 MPa Fos=yield strength/maximum stress

Fos= 460/200.57 Fos= 2.2

Left



Total Deformation=1.09 mm

Fig 2.8.3 Left impact test

Right

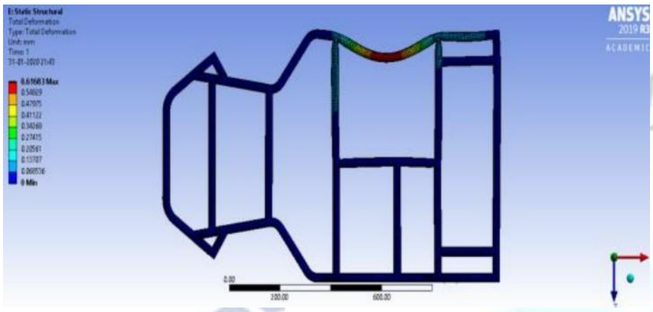


Fig 2.8.4 Right impact test

Total deformation= 0.6 mm

Dynamic Analysis

For every chassis designed, several tests will be done on the chassis in order to justify the functionality of the chassis. For example, dynamic analysis is the one of the common tests done on the chassis design.

Nowadays, there is a simulation function in the CAD software that enables the users to test their chassis design using the software after the modeling process.

In this project, the chassis design needs to be analyzed dynamically to determine the stability of the structure using simulation functions in ANSYS software.

The authors stated that when a vehicle travels along the road, the chassis of the vehicle is excited by the dynamic force caused by external issues such as the road condition and also internal issues such as engine and transmission.

There are groups of researchers performing analysis on their designed

chassis using Modal Analysis in ANSYS software after modeling of the 3 dimensional chassis design is completed .

The dynamic analysis is done to determine whether the natural

frequency of the chassis is in the suitable range.

Furthermore, performed vibration analysis on a vehicle frame and stated that the natural frequency of the structure coincides with the frequency from forced vibration that can cause resonance which could lead to failure to the structure.

Besides that, the analysis done is to determine the frequency in different modes.During the analysis, a few assumptions had to be made such as damping is ignored and any applied load is ignored. In the result, the natural frequency in each mode is determined.

Two basic aspects of dynamic analysis differ from static analysis. First, dynamic loads are applied as a function of time or frequency-.

Second, this time or frequency-varying load application induces time or frequency-varying response (displacements, velocities, accelerations, forces, and stresses).

These time or frequency-varying characteristics make dynamic analysis more complicated and more realistic than static analysis.

The term dynamic FEA relates to a range of powerful simulation techniques that can be applied to even complex engineering systems. Dynamic analysis is used to evaluate the impact of transient loads or to design out potential noise and vibration problems.

Evaluating the structure at design stage can avoid expensive mistakes

in real use of the product.It is essential to analyze vibration behavior of the chassis structure.

First chassis is designed in CAD Software, simulate in ANSYS

Workbench.

This represents the designing and the vibration attributes of chassis at different modes of vibrations for four different materials.Modal analysis is used to identify natural frequencies.

This research mainly focuses on the modal analysis where it deals with the natural frequencies developed in various modes which are responsible for the deformation of the chassis.

Here this analysis introduces various strategies of Dynamic Analysis.

This analysis is performed by using Ansys Workbench . Ansys is a software which is purely based on the finite element method.

This figures out six mode shapes at various frequencies. The characteristics of the mode shapes were explained further during the study.

Based on the analysis done the result is based on the first 30 frequency modes. The chassis maximum displacement in x, y and z direction is determined as well as the natural frequencies from the modal analysis.

2.8.1 TABLE : Natural frequencies for different mode shapes and different material

Mode shape	Materials			
	AISI 1018	AISI 1026	AISI 4130	AISI 1020
	Natural Frequencies(HZ)			
1	87	87.04	89.245	88.05
2	121.1	121.56	124.5	122.5
3	165.7	165.7	169.8	167.58
4	176	175.45	179.98	177.5
5	206.6	205.23	210.35	207.78
6	224.5	225.5	230.5	227.75
7	231.62	231.3	237.5	234.2
8	274.5	274.53	281.3	277.63
9	290.98	289.34	296.54	292.56
10	298.5	298.25	306.5	301.8

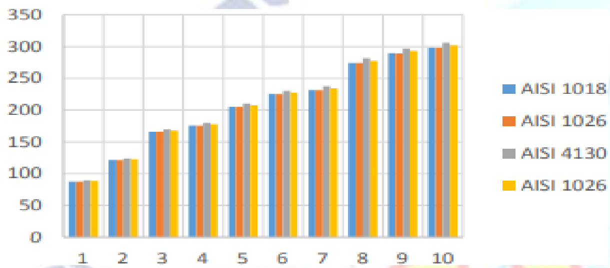


Fig 2.9.5 Comparison Among Materials for natural frequencies

Model of chassis is designed in CAD software which provided great flexibility to the designer and it is very easy to import for analysis in ANSYS

On the whole it is clear that there is no significant difference of material on the vibration behavior. But comparatively AISI 4130 gives good results for designed chassis.

Present analysis shows different mode shapes according to which material is deformed. Same mode shapes are found for all types of material which is quite interesting in this study.

Dynamic Impact test

In impact test ,ANSYS Workbench software is used to load and constraint the explicit dynamics model

The experimental result shows that the method of dynamic analysis is

practical and effective in calculating the stress and strain of the chassis impact test.

Calculations

Velocity = 15.27778 m/s Wall thickness = 100mm End time = .02s

Clearance between wall & chassis = 2mm

Maximum stress generated =300.2Mpa FOS = Fos=yield strength/maximum stress FOS = 460/300.2

FOS = 1.5

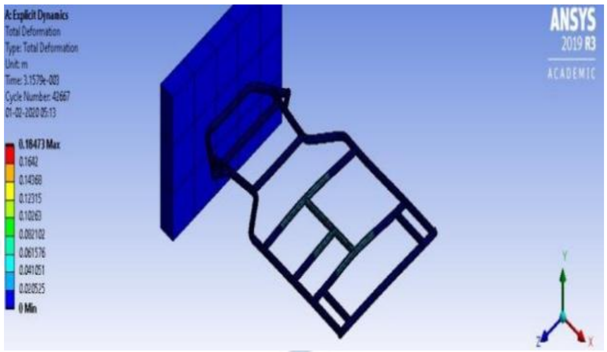


Fig 2.9.7 Dynamic analysis of the chassis

Total deformation = 0.18 mm

TABLE :2.9.2 STATISTICS

NODES	29633
ELEMENTS	29720

The results from these different analysis modes are accurate for the type and amount of loading that was applied to the known material and geometry.

They also assure the safety of the frame in the different cases of impacts. However, these loading scenarios generally do not exactly represent actual impact modes To accurately depict an impact or collision incident, dynamic loading would have to be used to simulate the types of impact loading that would occur during an actual collision.

It would be very difficult to accurately model this event without known data gathered from an actual collision in various lateral positions along with the longitudinal directions.

Furthermore, finite element analysis FEA will be conducted to find the stable chassis structure and the vibration analysis will be done physically using sensors and the data obtained will be transferred to the computer to be further analyzed and compared.

3. MANUFACTURING

All design work for the Go- kart championship has been done on the Ansys software. Using this program to produce a three dimensional model allowed easy revision of prebuilt designs, and gave design team members a visual picture of what the frame would look like.

After the design of the frame was finalized, a list of required support members was created and the frame model was modified.

The design for manufacturability, driver ergonomics,Welding and aesthetics for the roll cage are favourable for its reproduction, serviceability, and comfort. The material selected AISI 4130, has good manufacturability qualities.

Fig 3.1.1 Bending Operation

To increase manufacturability, many bends were used as frame members. These bends not only give the vehicle a leek, attractive look but also reduce the total amount of frame members and welds between these members resulting in a lighter, cheaper, and customized chassis. By implementing bends into the design of the frame, the number of cuts and welds were decreased. Decreasing the number of cuts and welds lowers the production cost and increases overall chassis strength.

For example, by using more bends, A bending die can perform the job of bending instead of the welding and joining hence reducing man-hours and production costs.

Fig 3.1.2 Bending The Material Of Chassis

All bends were designed to be made using a tube bender fitted with a diameter die, which would eliminate costly tooling changes from the manufacturing process.

Weight

Keeping the frame as light as possible was a top priority. When power is limited, vehicle weight is a large factor in vehicle performance.

The frame is one of the large and heaviest components of the car, and which is why special attention was given to it.

The strategy utilized to minimize weight consisted of determining defined goals for the chassis and employing the correct material in the best places to accomplish those goals.

Once baseline safety design requirements were met, CAD aided the material decision making process. CAD specifically helped to determine whether a member was under high or low stresses, in the scenarios discussed previously, making the chassis design process efficient and effective.

Chassis members were made out of inch (2mm) wall thinness and 1inch (25.4mm) outer diameter AISI 4130, this material was chosen because of its weight reduction capability and beneficial material properties, as was stated previously.

Through accurately determining stresses on the chassis in different scenarios, weight reduction was able to be maximized through material selection and placement. Also the simplicity of the frame design that is used for less number of members tends to reduce the weight.

TIG (TUNGSTEN INERT GAS) Welding

TIG Welding Machine has rigid and sturdy steel welded construction for minimum deflection of the frame. They are compact with an inbuilt for multi-productivity and operated with most advanced electronic control. Just as a NHRA (National Hot Rod Association) drag racing team depends on a blend of team talent to win races, the material selected for a particular application requires a blend of properties to withstand the stresses involved. For a drag racing chassis, and for many other motorsports and aerospace applications, that material is 4130 chromium-molybdenum, or chrome-moly, which is selected for its blend of ductility, strength, weight and fabrication advantages.

The 4130 grade of chrome-moly is a high-strength low-alloy (HSLA) steel that contains molybdenum (0.15 - 0.25 percent by weight) and chromium (0.8 - 1.1 percent by weight) as strengthening agents.

TESTING THE CHASSIS

A traditional carpenter's spirit level looks like a short plank of wood and often has a wide body to ensure stability, and that the surface is being measured correctly.

In the middle of the spirit level is a small window where the bubble and the tube are mounted. Two notches (or rings) designate where the bubble should be if the surface is level.

Fig 3.4.4 Chassis Under Testing With The Main Components

Aesthetics

The roll cage design is improved by the use of more rounded corners than the straight. The unique use of rounded corners allows for a more pleasing look to the vehicle's body as well as a reduced number of welded joints.

The use of continuous bended pipes also reduced the number of joints; the lack of sharp edges on the roll cage allows for the design of more streamlined body panels which not only look smoother, but may also have a positive effect on the overall aerodynamic drag forces.

TABLE : AESTHETICS

Consideration	Priority	Reason
Light weight	Essential	A light chassis is an advantage
Durable	Essential	Must not deformed during rugged driving Meet
Meet requirements	Essential	Must meet requirements to compete
Simple frame	High	Majority if the frame fabrication done in workshop
Attractive design	Desired	Easier to sell an aesthetically pleasing vehicle

4. CONCLUSION

The work is explained in such a way that everyone can easily understand and can follow the report. The steps to do the work are explained for all the objectives performed in this paper.

The calculation is done to get the best values of wheelbase and track width so this has helped us in designing a go-kart frame or chassis.

The scope of the study is achieved in the design section where the design is in such a way that it is very compact and also gives a good advantage over your opponent's in real-world conditions.

The design part is done in SolidWorks and ANSYS has been used to carry out the analysis.

The analysis has been carried out to evaluate, create and modify the best vehicle design to achieve its set of goals.

The main goal was to reduce the track width at the rear to improve the performance of the vehicle.

The overall design is carried out to make the vehicle light-weighted without sacrificing performance.

After following all these sets of goals one can achieve their compact design.

Basic consideration: The frame should contain fewer members to reduce the weight, the number of welds, and cost, Material selection should be done properly by considering the cost and its properties.

Design the frame with less number of bends if there are more bends we have to give more support.

The design of the chassis is so special that we have decreased the track width

Fig: 4.1 Auto Cross

This helps one to move swiftly during autocross, skidpad, and many more hurdles easily. So this consideration has been taken to make the vehicle more compact. The aim was to design a compact frame that can handle well in real-world conditions.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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