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A Review on Design and Analysis of Go-Kart Chassis

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***Abstract*—The automotive chassis serves as a frame work for supporting the body and different parts of the automobile. Also, it has to withstand the shock, twist, vibration and other stresses caused due to sudden breaking, acceleration, shocking road condition, centrifugal force while cornering and forces induced by its components. This paper reviews the design analysis of a go kart chassis. In this paper an effort is done to study and review the various go kart chassis and its structural analysis and other design related aspects as well as the research methodologies used by the researchers.**

***Index Terms*—Go-Kart Chassis Design, 3D Modelling, Solidworks, ANSYS, Finite Element Analysis**

I. Introduction

The Go-kart is a vehicle which is compact, simple, lightweight and easy to operate. The go-kart is designed for flat track racing so, its ground clearance is very small as compare to other vehicle hence it skips the suspension. The parts of go-kart are engine, steering, axle, tyres and bumpers. The engine used for go-kart is either two strokes or four stroke engines. The electric motors are also used instead of engine, known as "eco-kart". The chassis is independent of suspension to experience thrill. Go-karting is a great outlet for those interested in racing because of its simplicity, cost and safer way to race.

II. Chassis

The chassis of go-kart is a skeleton frame made up of pipes and other materials of various cross sections. The chassis of go-kart must consist of stability, torsional rigidity, as well as it should have relatively high degree of flexibility as there is no suspension. It can also adequate strength to sustain load of operator and other accessories. The chassis is design by convenience and safety for operator. The chassis was designed for a safe ride and the load is applied on it without compromising the structural strength.

III. Material and Methodology

The material used for chassis are various grades of steel or aluminium alloys. The main component of steel is carbon which increases the hardness of material of chassis. Aluminium alloy is expensive than steel so mainly steel is used to constructs the chassis. The chassis is widely made up of AISI-1018 which is a medium carbon steel. This material was selected due to its good Combination of all of the typical traits of Steel – high tensile strength, ductility, light weight, better weldability and comparative ease of machining. Material selection for Go-Kart Chassis dependent upon the following parameters:

- Machinability
- Strength of Material
- Weldability
- Availability
- Cost

TABLE I
Properties

Properties	AISI1010	AISI1015	AISI1018
Density (gm/cc)	7.87	7.87	7.87
Tensile Strength (Mpa)	365	385	440
Yield Strength (Mpa)	305	325	370
Modulus of Elasticity (Gpa)	190-210	190-210	205
Shear Modulus (Gpa)	80	80	80
Elongation in Break (%)	20	18	15
BHN	105	111	126
Rockwell Hardness	60	64	71

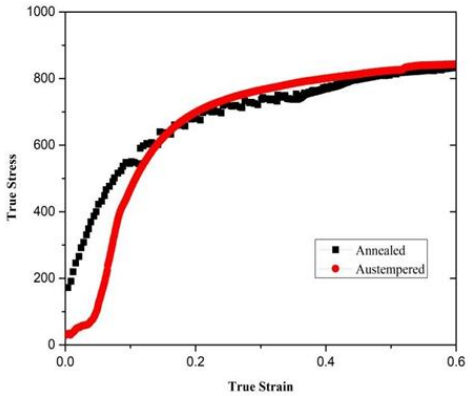

Fig. 1. Stress Distribution Curve of AISI-1018 Steel
(Source: Workability Study on Austempered AISI 1018)

IV. Design

The chassis is designed considering the factors like factor of safety - maximum load carrying capacity,

The main component of the frame is divided into two major

parts first the front block (cockpit) for steering and seat positions etc. and second rear block (engine compartment) for transmission and brake assembly.

Force absorption capacity, required space for accessories and driver and specific dimensions.

The design of chassis is performed by using software's such as AutoCAD and CATIA. The load distribution in the chassis should be uniform. The structural design gives the idea about the chassis. Design gives the optimum size and shape of the chassis.

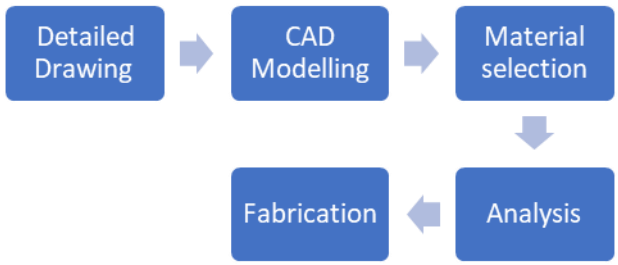

Fig. 2. Process planning for design

V. Analysis

The next stage after design is analysis of chassis under various impact forces. The chassis experience loads under condition such as cornering force, torsional rigidity and overall dynamic loads applied during race.

By performing analysis of,

a) Front Impact
b) Rear Impact
c) Side Impact

So, the design is analysed in CAD based upon these three one of the essential parameters of the chassis design.

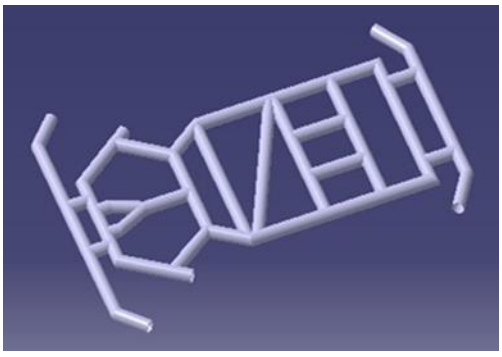

Fig. 3. CATIA Model of Chassis
(Source: Design and Analysis of Go-kart Chassis using CATIA and ANSYS [7])

- *Finite Element Analysis*

The structural analysis is done to know the effect of impact force on the chassis. The impact force testing is performed for worse conditions to determine the maximum deformation. For protection of driver, the frame of driver cabin should resist the impact forces. The driver safety can be checked and improved by analysis

TABLE I
Summarization of Methodology

Title &Author	Research Methodology used	Remarks and conclusion
Design and Analysis of Go-Kart Chassis Mr.Virendra.S.Pattanshetti (International Journal of Mechanical and Industrial Technology)	3D Modelling, Finite element analysis, CATIA-V5, ANSYS	Factor of safety is under the safe limit and can be used to make a Go- kart.
Design Report of A Go Kart Vehicle- Shaik Himam Saheb et.al (International Journal of Engineering Applied Sciences and Technology, 2016)	ANSYS, CATIA V5	This Report Provides A Clear Insight in Design and Analysis of Vehicle
Design and Analysis of Go-Kart Chassis D.Raghunandan*, et.al (International Journal of Engineering Sciences & Research Technology)	3D Modelling, SOLIDWORKS, ANSYS	The designing of the chassis for Go-Kart helps in identifying the strength and weakness of the build and design.
Static Analysis of Go-Kart Chassis- Mr. Kartik Kelkar, et.al (International Journal Of Research In Advent Technology)	CATIA , SOLIDWORKS, ANSYS	The result is a lighter, faster, and more agile vehicle that improves go-kart design.
Design And Analysis Of Automotive Chassis Considering Cross-Section And Material Vijayan, S. N.,Sendhilkumar, S. and Kiran Babu K. M. (International Journal of Current Research)	ANSYS,FEA	Based on the results it was inferred that steel with 'I' section has superior strength to withstand high load and induced low deformation and stress distribution when compared to S-Glass Epoxy composites material.

- *Meshing*

Meshing is probably the most important part in any of the computer simulations, because it can show drastic changes in results.

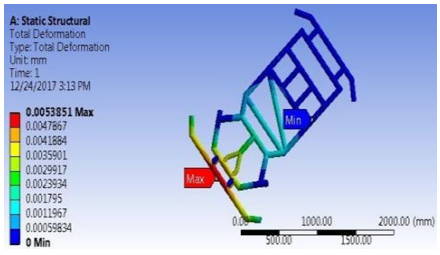

Fig. 4. Total Deformation in General Load Conditions
(Source: Design and Analysis of Go-kart Chassis using CATIA and ANSYS [7])

VI. Literature Survey

A. Go-Karts in India

Go-karts emerged in India in 2003 from MRF, which has a 125cc four-stroke engine, which produce 15 bhp of power, which costs around 3 lakhs. Indus motors are also offering Go-karting for 1 lakh to 3 lakhs. There are racing tracks in Nagpur for go-karting, which is known as the home of go-karts in India. Many people take part in the racing and is getting popular.

B. Go-Karts in Foreign Countries

Go-karts in foreign countries have much more performance than the Indians. One type is a single engine 160cc 4-stroke, kart with a maximum speed of around 40 mph and second type, a twin-engine 320cc 4-stroke kart used in outdoor with a maximum speed of 70 mph. There are hundreds of racing tracks in US for karting and also, they are much more professional than the Indians.

VII. Conclusion

The designing of chassis for go-kart can develop many skills. In this review paper, some researchers and their research methodology with remarks is included so it can be concluded the analysis of design determines the stresses developed in the chassis which plays an important role in factor safety. From the analysis Design Engineer can predict the chassis is safe or not and also by seeing the deformation and stresses modification in the kart chassis is possible.

Acknowledgement

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