DESIGN AND ANALYSIS OF GO KART CHASSIS

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***Abstract*: Go kart is a vehicle in which, it has four wheels and it is two wheel drive. Go-kart has very less ground clearance. No suspension used in go kart. In go kart generally used 100cc to 160cc engine. It is a simple, normal vehicle in which it is used for entertainment, fun, and especially for racing adventure. Adult and enthusiastic persons are using go kart for fun and racing. In chassis of Go-Kart, some modification for better strength and better performance has been carried out. Go kart is a base of F1 car. The go kart chassis is simple and lightweight and close-packed. Go kart chassis is the main constitution of road vehicle design. Chassis strength is a chief aspect that required to be considered in the study of a Go Kart vehicle design. Since the strength of the chassis material can be accomplish on the stability and safety of the vehicle. Because most of the load is fully dispense along the chassis. It will be having some condemnatory point due to part that have more change over the beam portion especially rider weight.**

Keywords: Go-Kart, Race, Chassis, Engine, Vehicle Design

I. INTRODUCTION

The go kart tracks are same as in F1 race track. The go kart is designed for racing and compared to other vehicles it has very minimum ground clearance. Go kart is simple vehicle which is light weighted, dense and effortless to operate. In a go kart suspension is absent. In go kart there are karts which has open wheel, and they come in all types of shape and size. Many karts are having four stroke engines. And most of the go kart is single seated. In many countries go karts are driven on regular road and some countries are banned go kart for drive on public road. In this kart, manufacturing has been carried out on the basis of basic design terminology of automobile and accordingly studied the go kart design and chassis analysis, and in design of the chassis, design is made in solid work and the analysis of chassis design is done on ANSYS. The safety factor of go kart and chassis is to absorb the impact loading which studied in design and analysis method. This paper is related to design and analysis of go kart chassis in static and dynamic conditions.

II. OBJECTIVES

The objectives of the paper are as follows:

1. The material selected for go kart chassis.
2. Design the appropriate chassis for a go-kart.
3. To avoid the highest stress concentration.
4. Build stable go kart.

III. OPPORTUNITY

Go-Karting is a popular trend in the engineering institute and it is traditionally followed by many institutes in various countries. Go kart racing tracks are available in India in various locations like Nagpur, Chennai, and Bangalore. In India some companies are manufacturing go kart in small scale. Since go kart is not allowed on road legally and it is also little bit expensive, due to this reason there are many international and national go Karting championships, which help the engineering students to improve and enhance their technical skills.

IV. ABOUT GO –KARTS

Go-kart is a simple, small engine, single seater racing car mainly used in the USA. By definition GO-KART has zero suspension and also no differential. They are generally ride on the scaled down road, but sometimes run as a hobby or as entertainment by vendors. Kart racing is a generally accepted as the cheap form of motor sport up for grabs. As a free-time adventure, it can be performed by almost all youth and adults.

Kart racing is usually used as a cheap and relatively risk-free way to introduce drivers to motor racing. Many people connect it with teenage drivers, but adults are very interested in karting. Karting is considered as the first footstep in any successful racer's career. It can read to racer for take high rush wheel-to-wheel racing to develop good reflexes, precision kart command and decision-taking skills. In addition to this, it brings an aware of different parameters that can be change to try to upgrade the militant of the kart that also exist in other forms of motor sport racing.

V. PARTS OF A GO –KART

In a Go-Kart, there are mainly six parts. They are

1. Chassis
2. Engine
3. Transmission
4. Steering
5. Tires

6. Brake

VI. DESIGN METHODOLOGY

– The design of any Part is consists of three major principles:

1. Optimization
2. Safety
3. Comfort

Its primary intention is to provide authentic mounting for parts, cheap in cost and fragment low in weight. These impartial were met by sort-out an open cage material that has good strength and also low weights, giving an advantage in weight minimization. A low cost open cage was supplied through material selection and include more uninterrupted members with crooks rather than an assembly of members welded together to minimize manufacturing costs. The modeling of the open cage formation is done by using cut v-5 software. This design is analyzed by Finite Element Analysis. We have focused on all point of open cage to upgrade the performance of vehicle without failure of open cage. In this paper work of designing has been began by governing an extensive research of go kart between finite element analyses.

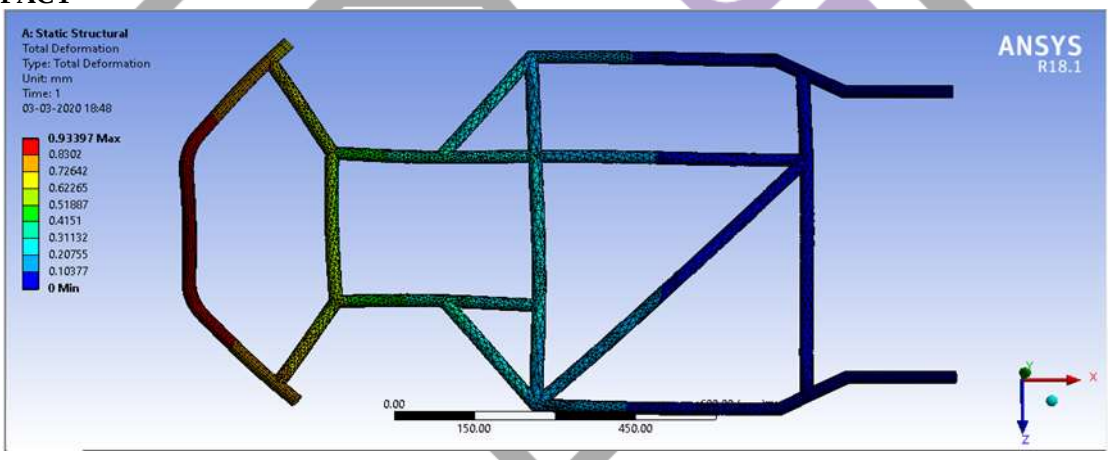
VII. MATERIAL SELECTION

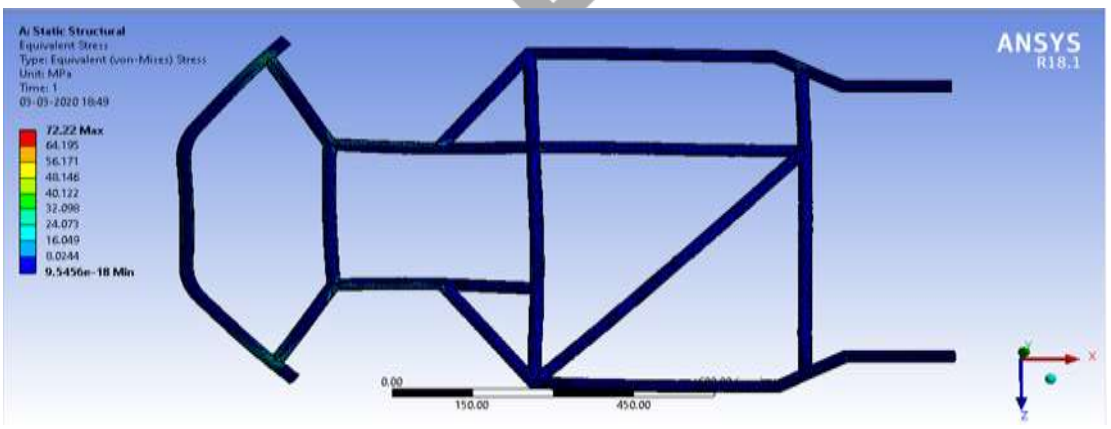
The selection of material is a soulless duty for this kart, as it had much restraint of weight, genesis resilience, types of forces, torsional rigidity, factor of safety under appeal of varied charges and also market availability with pricing and cost constraints.

The open cage design is designed by the design team and analyzed after application of various loads as calculated by the legitimate strategy and mathematical calculations based on physical theories. The main purpose behind the selection of various materials for the open cage and the other parts is to get the better and safer results in case of driver's safety and actual time load bearing capability [7]. The bumper furnishes the safety by absorbing the maximum impact force and protects the chassis.

The consignment of carbon in steel is chief to decide the strength, hardness, and providing desired strength, fortitude, safety and reliability of the kart. The material used for the chassis are contrary types of steel and aluminum alloys. The main element of steel is carbon, which enlarge the hardness of material of chassis. Aluminum alloy is costly than steel so mainly steel is cast-off to set-up the chassis. [3] The chassis is buildup of AISI-1018 which is a medium carbon steel. This material was designate due to its good Combination of all of the typical traits of Steel – high tensile strength, ductility, light weight, superior weld ability and qualified ease of machining.

VIII. FRONT IMPACT





Deformation	1.47 mm
Max. Stress	173.65 Mpa
Factor of Safety	2.04

For the front side impact, engine and driver, effort was given at respective points. The kingpin mounting points and rear wheel position keep fixed. The Front impact was fined for a best speed of 60 kmph. From the impulse momentum equation, 5g force has been applied. The loads were applicable in the front end of the chassis due to application of loads at one end, when constraining another, results in a more conservative approach of analysis. Time of impact advised is 0.2 seconds as per industrial standards.

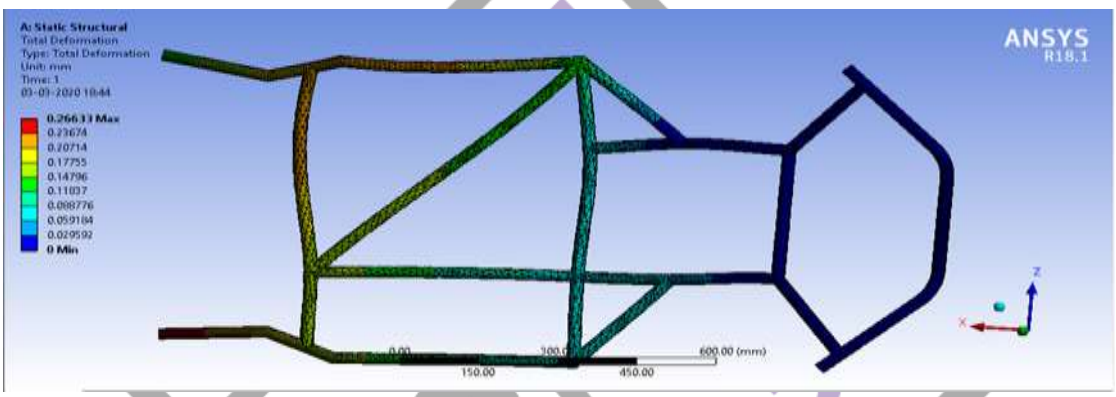
F x t = m x (Vi - Vf)

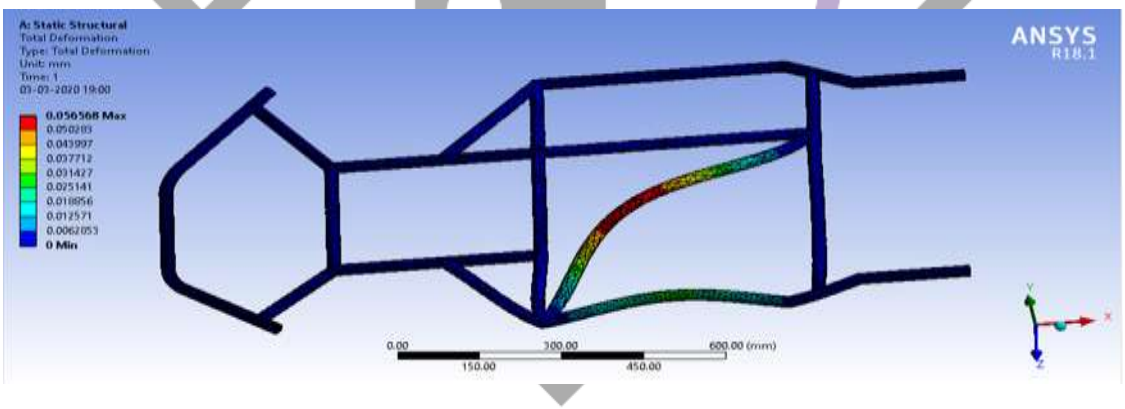
F x 0.2 = 180 x (16.38 - 0)

F=14.7 KN

IX. SIDE IMPACT

Deformation	1.46 mm
Max. Stress	326.5 Mpa
Factor of Safety	2.17





The most extreme condition of an impact from the side would be with the vehicle is having in motion. So it was not consider along from only one direction. The vehicle would be a fixed object. For the side impact the velocity of vehicle is taken 30 kmph and at the same time of impact considered is 0.2 seconds as per standards. The .Impact of force applied on left side of chassis and applying load Emulous to 2.5 g force on the right side.

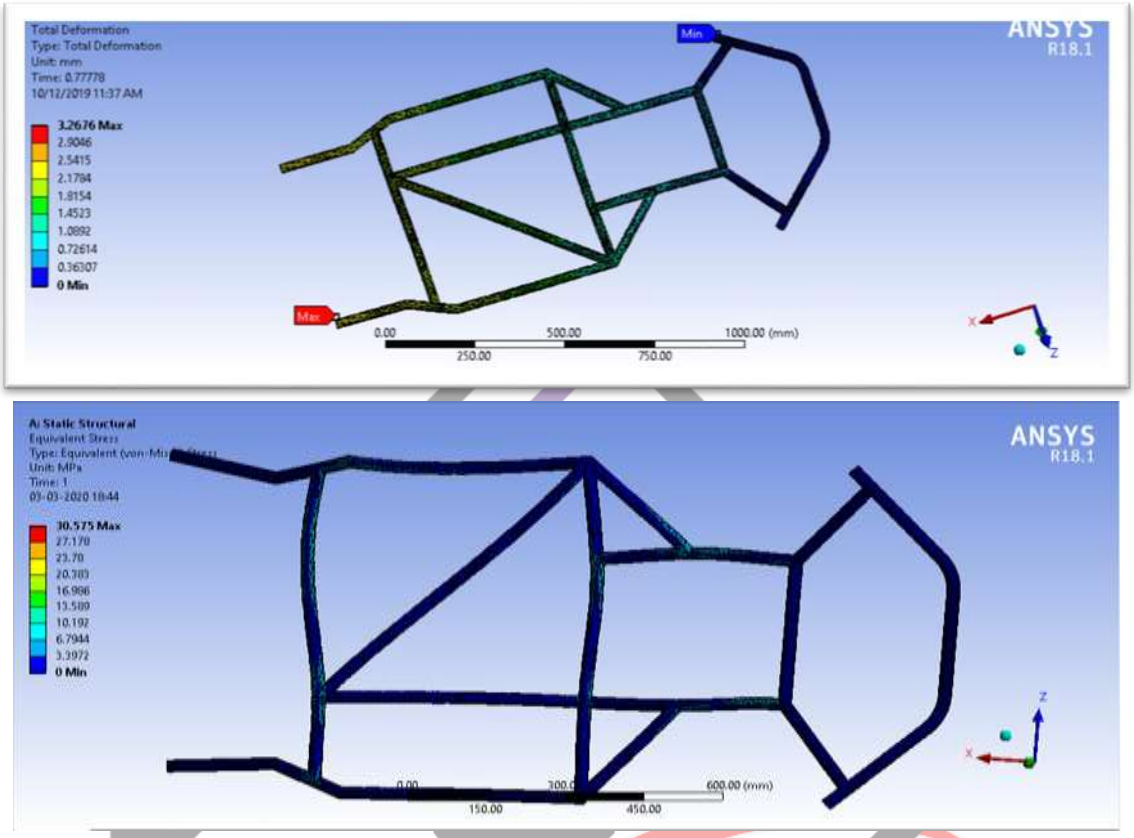
F x t = m x (Vi-Vf)

F x 0.2 = 180 x (8.19)

F=7.35 KN

X. REAR IMPACT

Deformation	**2.74 mm**
Max. Stress	**444.854 Mpa**
Factor of Safety	**2.73**



Considering the worst-case collision for rear impact, force is calculated as similar to front impact for a speed of 60 kmph. The value of 5g force has been calculated. The load was applied at the rear end direction of the chassis while constraining front end and king pin mounting points. Time of collision considered is 0.2 seconds as per caliber.

F x t = m x (Vi-Vf)

F x 0.2 = 180 x (16.38 -0)

F=14.7 KN

XI. NODAL ANALYSIS

It is seen in nodal analysis that the maximum vibration (240 Hz) of the chassis and the minimum vibration (0 Hz) of the chassis don't match the natural frequency. As the equal causes resonance which might create crack on the chassis.

XII. MATERIAL PROPERTIES AND THEIR COST

PROPERTIES	AISI1010	AISI1015	AISI1018	AISI1020
Density (gm./cc)	7.87	7.87	7.87	7.87
Tensile Strength (Mpa)	365	385	440	420
Yield Strength (Mpa)	305	325	370	350
Modulus Of Elasticity (Gpa)	190-210	190-210	205	205
Shear Modulus (Gpa)	80	80	80	80
Poisson Ratio	0.27-0.3	0.27-0.3	0.29	0.29
Elongation in Break (50mm)	20%	18%	15%	15%
BHN	105	111	126	121
Rockwell Hardness	60	64	71	68
Thermal Conductivity (W/mK)	49.8	51.9	51.9	51.9
Cost	250/meter	1083.33/meter	200/meter	100/kg

XIII. CHASSIS

The chassis is designed with convenience and safety for operators. The chassis has been designed by taking proper material properties like the chassis of go-kart is a skeleton frame made of pipe materials of different cross sections. The chassis of go-kart is must be steady with topmost torsional rigidity, as well as it should have a relatively high degree of flexibility as there is no suspension available. The chassis is constructed with the MS AISI 1018 grade circular cross section pipe as per dimensions and bends in the required places using bending machine. Then the pipes are welded rigidly. Strength evaluation is made. The result of Maximum stress front impact is 173.65 Mpa, and maximum deformation 1.47 mm. The side impact Maximum Stress is 326.5 Mpa and deformation is 1.46 mm

XIV. CONCLUSION

The design of chassis of GO-KART has become more challenging due to the various parameter and material properties. It has been designed by considering the basic terminology of various automotive systems. Thus this report provides a clear insight in design and analysis of kart chassis. The making of this paper has helped us in learning of different types of design for the purpose of making Go-Kart chassis. It has been designed by keeping in mind the safety of the driver as well as the kart and also which is less in weight. We have integrated many sensors in the go-kart and also some automated systems have also been used and we call it as smart go-kart.

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