Design and Optimisation of chassis for a single seater Go-Kart

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Introduction

A Go Kart/Cart is a vehicle constructed & made for racing only. It is a miniature form of a racing car. A Go Cart isn't a factory-made product; it can be made by Automobile engineers. Go-kart have single sealed racing car and a small engine that is used mainly in countries like US. They were originally designed in the 1950s for the recreational activities of the airmen. American Art Ingels is considered to be the father of kart racing. He was a race car builder at Kurtis Kraft, where he builds his first kart in South California (US) in 1956. After this, it was popular all over America and few parts of Europe. A Go-kart has no differential or suspension. They are ordinarily raced on a down scaled tracks. Also sometimes driven for leisure or as an amusing hobby by non-professionals. Karting is generally recognized as a steppingstone to professional level in the field of motor sports. Kart racing is perceived as the most commercial form of motor sport that is available. Karting can be done by anyone as a pass time sport activity, that Grants licensed racing for anyone above 8 years of age. It is commonly used as a cost-effective and comparative safe way to acquaint drivers to motor sports. A lot of people that are associated to it are youngsters, but adults are involved too.

Design Parameters

The important parameters which are required for designing an efficient Go-Kart are:

Weight loads -: The loads that vehicle can Carry with no damage.

Rolling resistance -: The friction force Result from the contact between tire Surface and concrete road surface.

Aerodynamic drag -: Resistance is caused by the motion of the vehicle. That is usually depending on the shape of the vehicle design. Different analyses were performed in CAD software (such as CREO, SOLID WORKS, etc.). Use ANSYS FEA software. Based on the result, the model is modified and reconstructed.

Design of Frame: The goal of the frame is to package all elements of the kart and to bear the various static and dynamic loads.

Throughout the exterior and implementation process, the main aspects of the chassis is about the safety of driver, weight of structure and drive system integration.

The appearance is decided as per the competition guidelines and by thorough analysis.

Design: - the elements of the frame is especially divided into 2 elements.

1. Cockpit
2. Engine Compartment

Cockpit: This compartment includes the management and also the driver within the vehicle. i.e. Driver's seat and braking and acceleration controls.

Engine compartment: - This compartment consists of gear box, braking and engine itself.

The vehicle should be able to achieve the following goals:

Safety, strength, robustness, standardization, cost, driving sensation, applied science, aesthetics, light weight, high performance.

Steering systems, gearbox systems, brake systems, electrical control systems, etc., combine to create the most efficient and accurate go-karts.

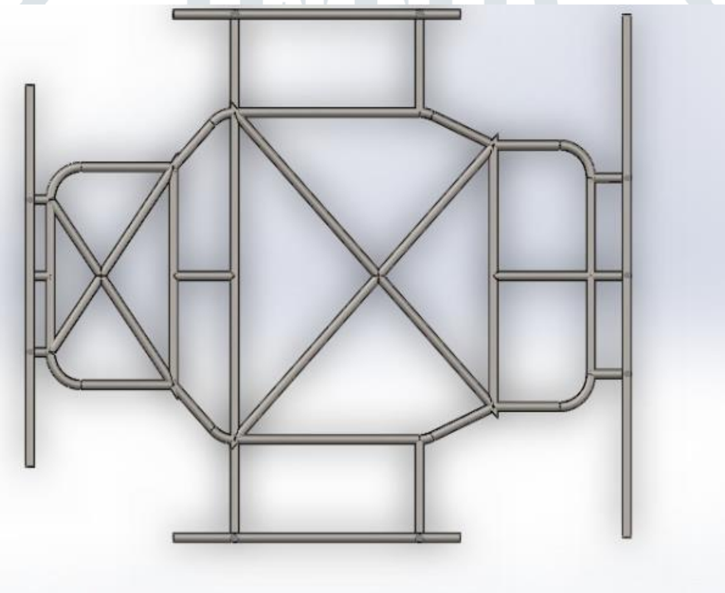

Figure 1 A Chassis Design

Kart design methodology

Manufacturing of Go-Kart involves a number of processes like Calculations, Modelling, Dimensioning, Manufacturing, Testing and finishing. After testing, some modifications can be done based on the results of the tests.

Calculation: Each department have done their calculations in order to manufacture the vehicle under given parameters.

Designing & Dimensioning: As per the calculation, designing of chassis and the analysis of that chassis was performed.

Manufacturing: After prototyping of the chassis the go-kart was manufactured. The manufacturing was performed with the making of the frame by bending, cutting and welding of the hollow pipes. After that mounting of different essential parts of the vehicle like engine, brakes, steering etc was done.

Testing: After the manufacturing testing like speed test, turn test, brake test etc. was performed in order to make it less prone to any kind of failure.

Modification: After the testing whatever the failure the vehicle will be facing will get modify or replaced with new parts in order to eliminate the chances of failure in the future.

Design and Analysis

The total weight of the go-kart is considered 160kg.

The calculated impact force supported G-load of five.

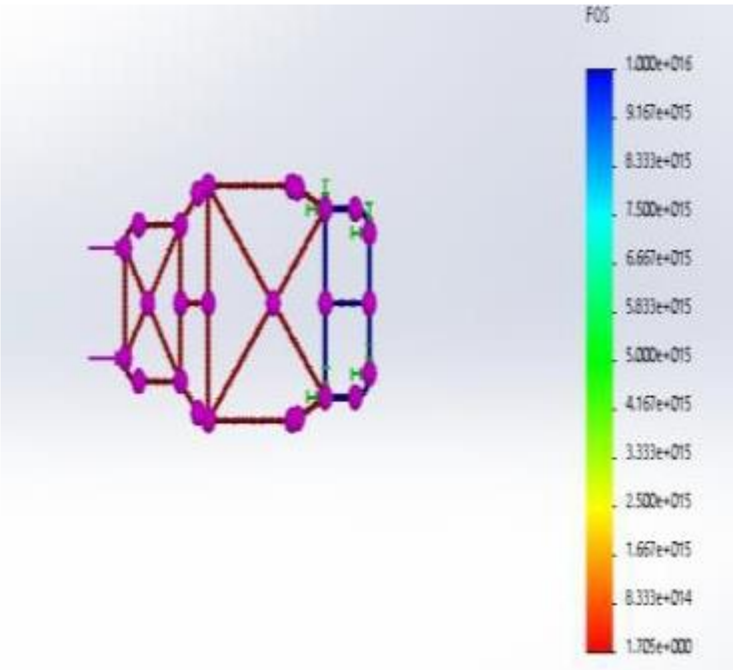

Figure 2 Front Impact Analysis

Load Applied: 7000N

Deformation Scale: 131.142mm

Displacement:

Factor of safety: 1.7

Yield Strength: 3.516e+008

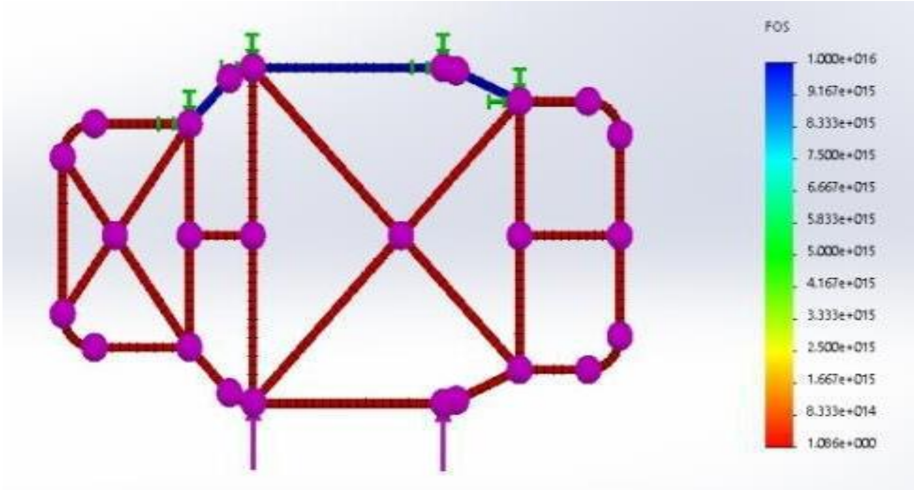

Figure 3 Side Impact Analysis

Load Applied: 4000 N

Deformation Scale: 59.9024

Displacement:

Factor of safety: 1.1

Yield Strength: 3.516e+008

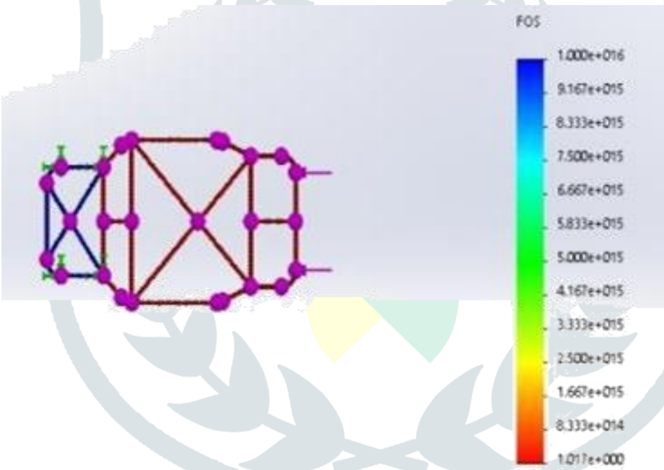

Figure 4 Rear Impact Analysis

Load Analysis: 7000 N

Deformation Scale: 67.0109

Displacement:

Factor of safety: 1

Yield Strength: 3.516e+008

Material: AISI 1020 may be a low hardenability and low strength steel with a Brinell hardness of 119 – 235 and a durability of 410-790 MPa. It has high processability, high strength, high ductility and reasonable welding ability. Usually used under turning, polishing or cold drawing conditions. Since the square of a 1-inch diameter pipe with a thickness of 2 mm was required to be measured, it is easy to fold, light weight and has reasonable welding capacity. Due to its low carbon content, induction hardening or flame hardening can be prevented. Due to its low carbon content, induction hardening or flame hardening can be prevented. It does not return to nitridation due to the lack of alloy parts. However, carburization is possible so that the surface hardness of the smaller cross section reaches Rc65 and decreases as the cross-sectional size increases. The core strength can be maintained because it is equipped for all parts. As an alternative, carbonitriding treatments are often performed and provide a bonding edge for normal carburization.

Table 1 Material Comparison

Material	**1020**	**1018**	**4130**
Tensile Strength	57,249 Psi	63,800 Psi	81,200 Psi
Yield Strength	42,748 Psi	53,700 Psi	66,700 Psi
Elongation	17 %	15 %	13 – 26 %
BHN	111	126	200 - 300
Cost	295 /m	500 /m	695 /m

SEAT: - The seats in the karting are also designed to be very lightweight. The very simple material is fixed to the chassis only by four points, and the angle of the backrest can be adjusted according to the driver's requirements, so that the driver's rear seat angle is comfortable. The seat has an angle of 17 degrees and, according to ergonomics, it is in a good position for the rest of the driver's body and is almost parallel to the firewall. The seats in our karts combine weight reduction and technology.

Steering System Design

Objective: The mechanism may be a cluster of elements that transmit the movement of the wheel to the front, and typically the rear, wheels. The first purpose of the mechanism is to permit the motive force to guide the vehicle. Once the vehicle is being driven straight ahead, the mechanism should keep it from wandering while not requiring the motive force to form constant corrections.

The mechanism should conjointly enable the motive force to own some road feel (feedback through the wheel regarding paved surface conditions). The mechanism should facilitate to take care of correct tire-to-road contacts. For optimum tire life, the mechanism ought to maintain the right angle.

Components of Steering System:

- Steering wheel
- Steering shaft
- Pitman arm
- Bearing
- Tie Rod
- Stub axle
- Heim joint
- Universal Joint

Calculations:

1) Inner angle (θ) = $\tan^{-1}$ ((WB)/(R-TW/2))

$$\theta = 33.38°$$

Outer angle (Ø) = $\tan^{-1}$ ((WB)/(R+TW/2))

$$ø = 23.134°$$

ø

2) Ackerman angle (α) = $\tan^{-1}$ ((WB/ (WB/tanØ)-TW))

$$\alpha = 33.38^0$$

3) Ackerman Percentage = ((inner angle/Ackerman Angle) ×100

= 100 %

4) Turning Radius –ROF = 2.598 m

CONCLUSIONS

The paper provides sufficient planning and style guidelines that can be used to create appropriate reports that are valuable to the successor of applied science and help them grasp the need for project and project reporting. The issues mentioned in the previous pages provide only a wide range of information.

Based on the results obtained, the goals of the project can be achieved and completed within the planned time frame. The car chassis of the Go-Kart is designed in CAD, and the image is designed by the partial damage of AISI1020 steel. The practicality of the car style was examined by the FEA kit, which was then verified by experimental analysis of the AISI 1020 steel car image. The static analysis of the victim finite element technique was successful, and most of the deflection and its position on the chassis structure can be seen. The results show that the maximum deflection is in good agreement with most of the theoretical directions of the straight beam. This study determined the difference between theoretical (2-D) and numerical (3-D SOLIDWORKS) results.

References

[1] Jeyanthi Rebecca, L., Dhanalakshmi, V., Sharmila, S., Effect of the extract of Ulva sp on pathogenic microorganisms, Journal of Chemical and Pharmaceutical Research, v-4, i-11, pp-4875-4878, 2012.

[2] Sharmila, S., Jeyanthi Rebecca, L., GC-MS Analysis of esters of fatty acid present in biodiesel produced from Cladophora vagabunda, Journal of Chemical and Pharmaceutical Research, v-4, i-11, pp-4883-4887, 2012.

[3] Anbuselvi, S., Rebecca, J., A comparative study on the biodegradation of coir waste by three different species of Marine cyanobacteria, Journal of Applied Sciences Research, v-5, i-12, pp-2369-2374, 2009.

[4] Arunachalam, A.R., Bringing out the effective learning process by analysing of E-learning methodologies, Indian Journal of Science and Technology, v-7, i-, pp-41-43, 2014.

[5] Sharmila, S., Jeyanthi Rebecca, J., A comparative study on the degradation of leather industry effluent by Marine algae International Journal of Pharmaceutical Sciences Review and Research, v-25, i-2, pp-46-50, 2014.

[6] Anbuselvi, V.S., Isolation and characterization of polythene degrading bacteria from polythene dumped garbage, International Journal of Pharmaceutical Sciences, Review and Research, v-25, i-2, pp-205-206, 2014.