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Static Analysis of a Go-Kart Chassis

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Abstract: **The National Kart Racing Championship is aimed to bring out the Innovations and creative potential of young automobile enthusiasts. The basic outline of the event consists of designing and fabricating a go-kart. We had made a go-kart having creativity with few restrictions mentioned in the rule book. The real essence of creating the go-kart lies in the sheer engineering practical applications and tests it in real time. The chosen project is based on the design and analysis of the chassis of a low ground clearance Go-kart. The project aimed to create a chassis that possesses good performance and features. This is done by carrying static analysis from theoretical knowledge and analytical methods using hyper mesh.**

Design and fabrication of the Go-kart focuses on developing a simple and easily operated vehicle. Aspects of ergonomics, safety, ease of manufacture, and reliability are incorporated into the design specifications. 3 D models have been made for analysis purpose in SOLIDWORKS and analysis has been made in hyper mesh. 3D assembly models of the go-kart are designed for understanding purpose.

This paper aims to model, 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 rulebook provided by National kart Racing Championship (NKRC-15).The maximum deflection is determined by performing static analysis.

Keywords: **Go-kart, Chassis, FEA, Analysis. Etc.**

1. INTRODUCTION

The Chassis and steering systems are crucial to successful operation of any variety of cars. Due to the large responsibility that these major components share coupled with the fact that race cars are capable of reaching very high speeds and accelerations, it is obvious that consequences of failure or improper setup of the Chassis and steering could be quite catastrophic.

The project aims to find, coupled with appropriate research, to create a Chassis that possesses improved performance. While striving to achieve these major aims, project work will focus on a two basic objectives.

1] It is intended that the final design will be easily adaptable and adjustable such that future teams can incorporate or modify the chassis and steering systems without too much hassle.

2] It is hoped that the work documented in the project will be able to serve as a significant aid to these future teams whether they nominate to use the final design produced from this project or even if they choose to start from scratch.

2. STATIC ANALYSIS OF THE GO-KART CHASSIS

Chassis Design details:

Gross Vehicle Weight (GVW): 60kg

Gross Combined Weight (GVW + Payload): 60+80kg =140kg

Material Properties

Normalised AISI 4130

Modulus of Elasticity = 210Gpa

Poisson's Ratio = 0.3

Sr. No.	Chassis Material	Specifications
1	Type (Seam or Seamless) & Grade	Seamless
2	OD (outer diameter)	25mm
3	Wall thickness	3mm
4	Cross section (circular, Rectangular, Square)	Circular
5	Material testing Certificate (Yes/No)	Yes

Sr. No.	Vehicle Dimensions	Measurement
1	Max width of vehicle with wheels pointing forward direction	58 inches
2	Length of vehicle (front to rear bumper max extended length)	79.5 inches
3	Wheel base (42 inches to 56 inches)	52 inches
4	Wheel track (At least 75% of minimum wheel base)	45 inches
5	Front wheel track (in inches)	45 inches
	Rear wheel track (in inches)	58 inches
6	Ground Clearance (Minimum 1 inch)	1.35 inches

Sr. No.	Power train	Specifications
1	Engine type	Single cylinder, Gasoline(Access Engine)
2	Maximum Capacity	124cc
3	transmission type(Manual, CVT , Centrifugal Clutch)	CVT
4	Maximum speed	72 km/hr
5	Power train guard	Provided

Front Impact Analysis to test the impact strength of the chassis:

In order to test how the chassis deforms on direct collision into a wall or other body the analysis is done in Hyper mesh assuming an impact force of 4*g N in front and rear direction and 2*g in right hand and left hand side impact test.

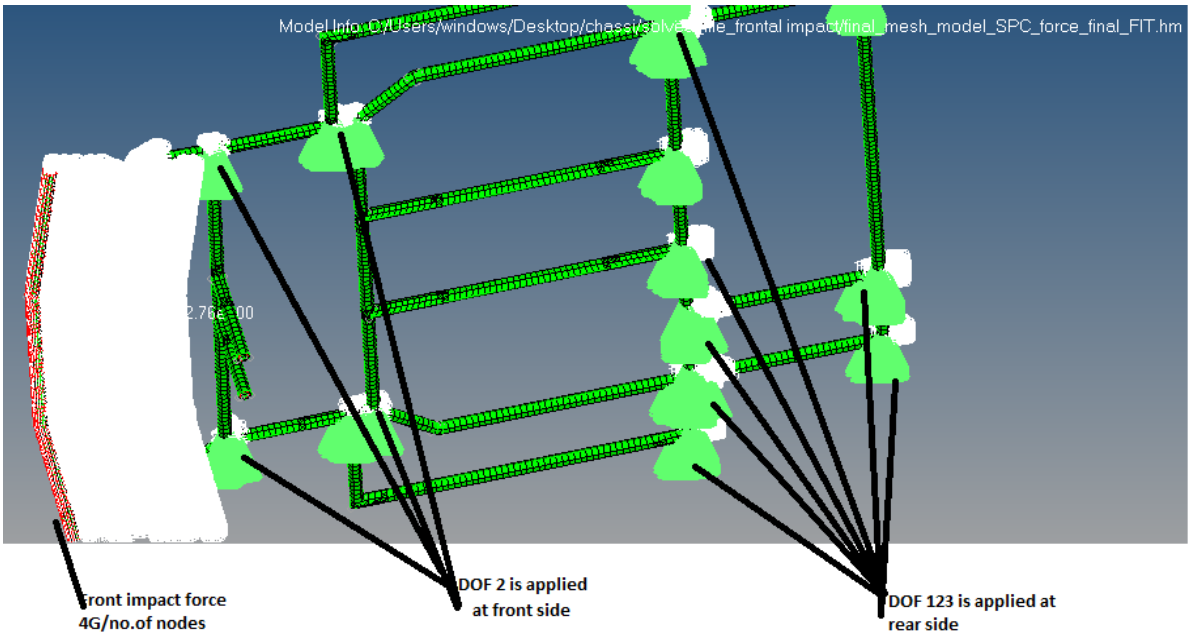

Fig. No.1. Boundary conditions for front impact test

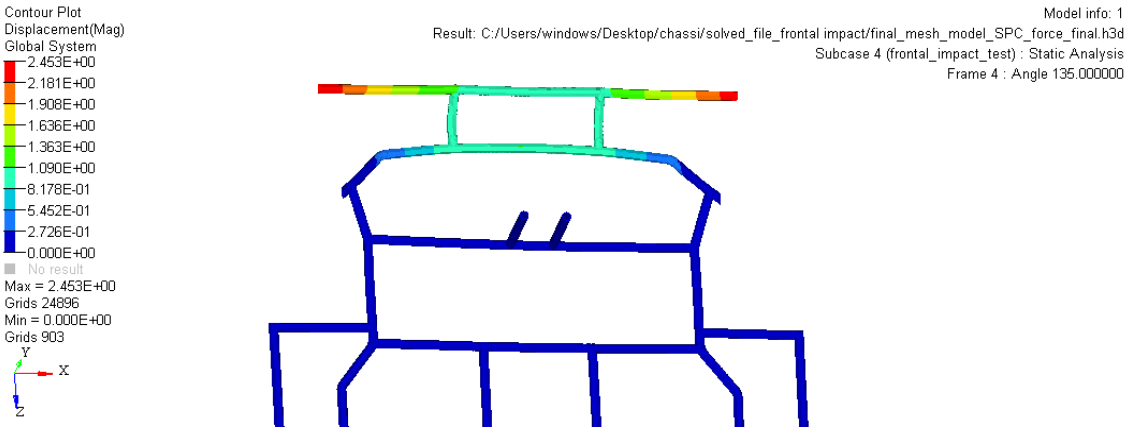

Fig.No.2. Displacement Plot for Front Impact Test

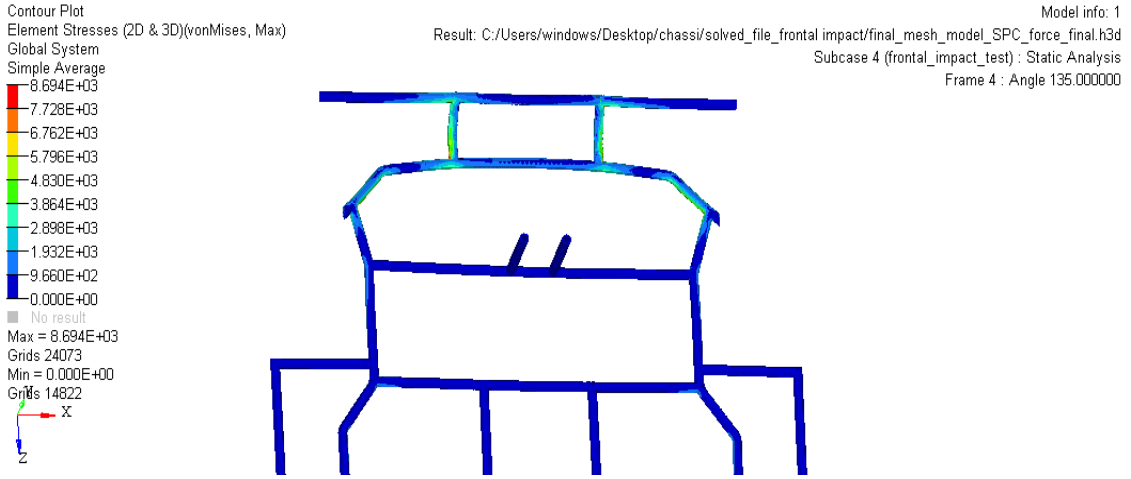

Fig.No.3. Stress plot for front impact Test

The results are summarized below:

1. Assumed impact force at maximum deforms the chassis at the front portion by 2.45 mm

2. Chassis can withstand a collision of 4*g force.

3. Since go-karts travels at smaller velocities chassis built is safe till 60kmph velocity roughly calculated.

Side impact test:

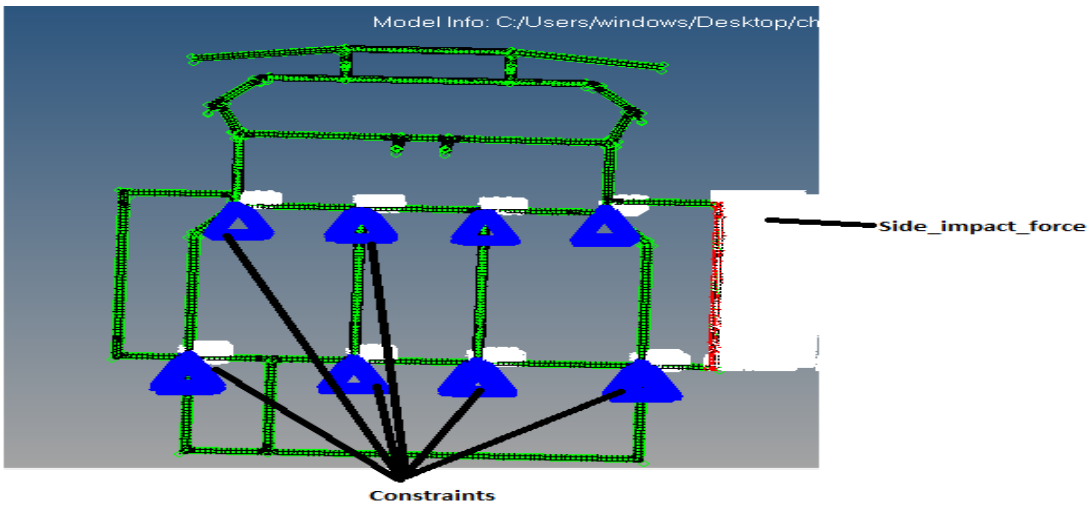

Fig.No.4. Boundary condition for side impact test

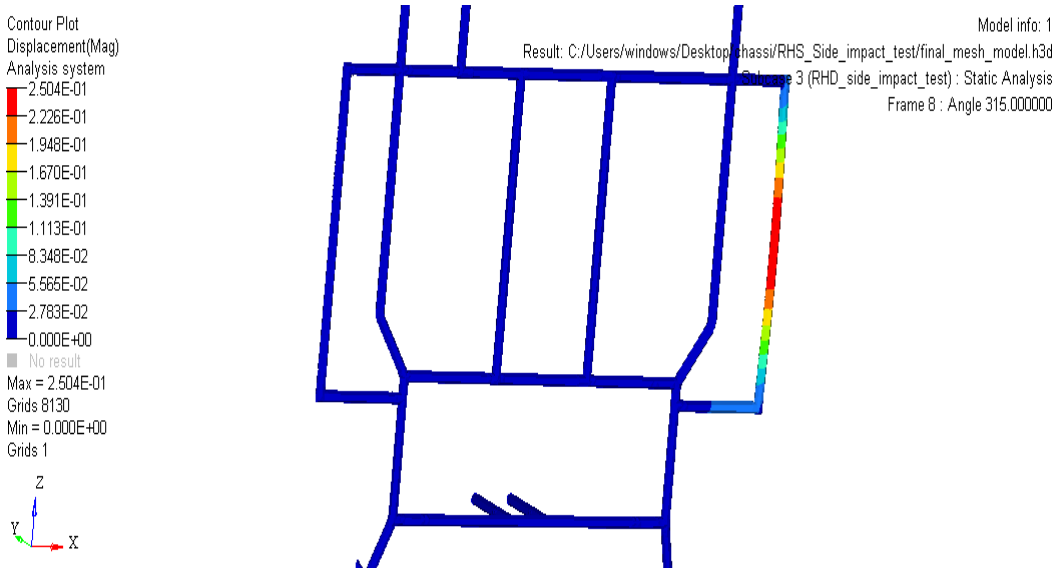

Fig.No.5. Displacement plot for Side impact test

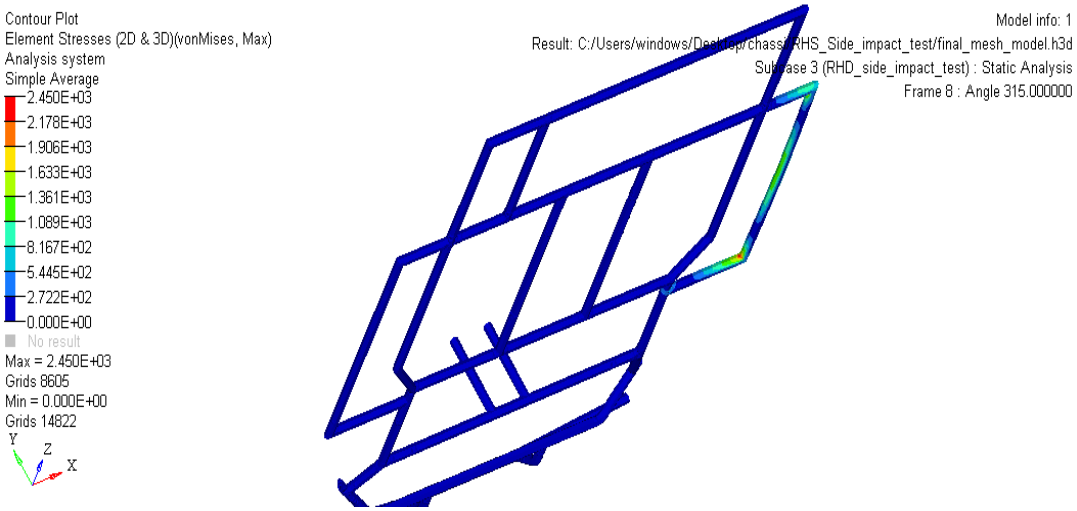

Fig. No.6. Stress Plot for side impact Test

Rear impact test:

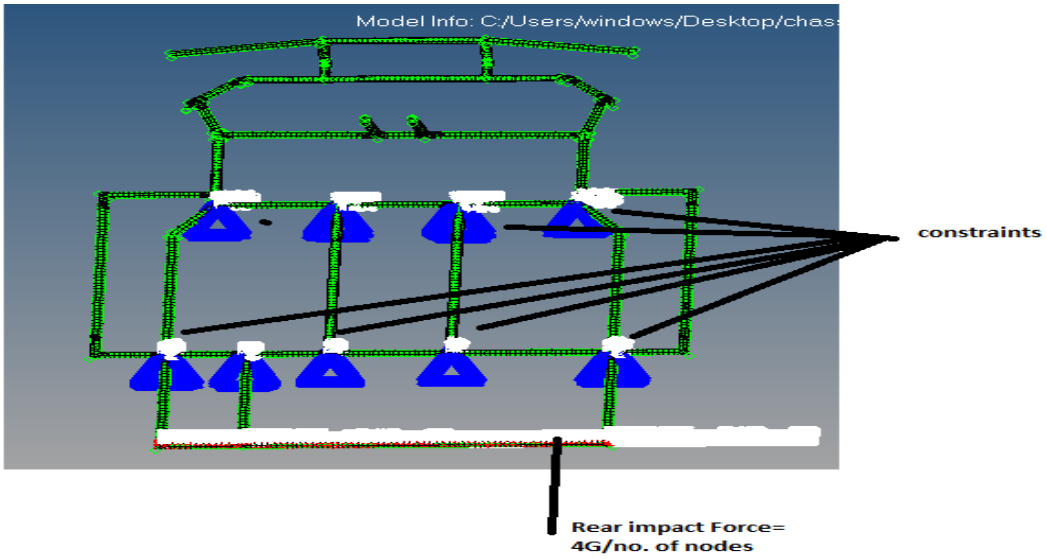

Fig.No.7. Boundary condition for Rear impact test

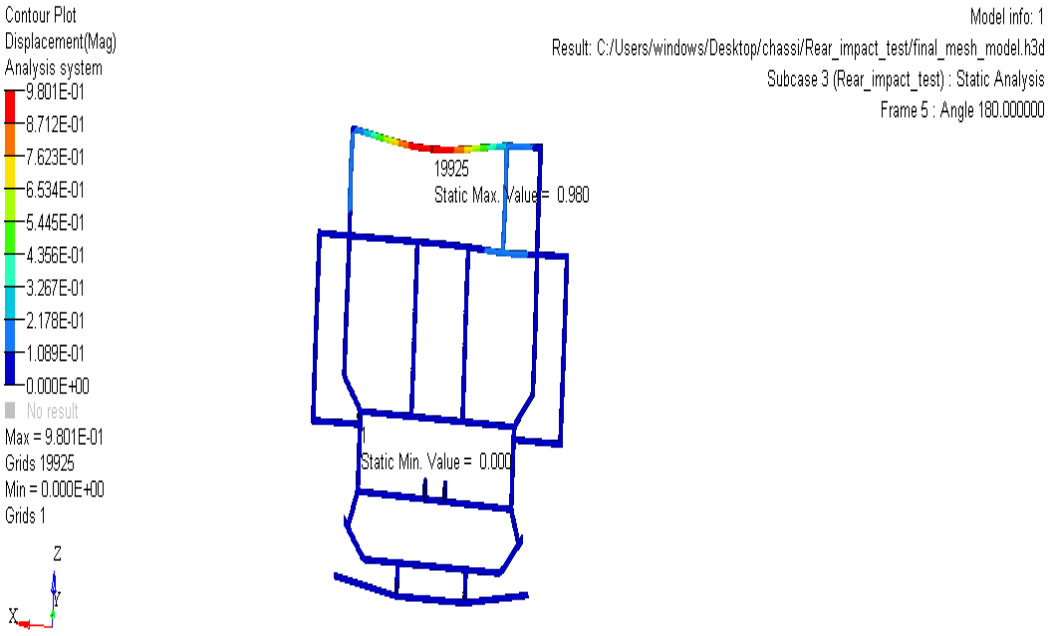

Fig. No. 8. Displacement Plot for Rear Impact Test

Fig. No.9. Stress Plot for Rear impact Test

3. CONCLUSION

This paper discussed about the design and fabrication of a go-kart vehicle giving special attention to improvement of chassis system. Thus the kart was designed using basic automobile principles. It is analyzed using finite element techniques to prove its effectiveness. There were many challenges throughout the design process. To come up with an excellent racing kart the subsystems were designed in such a way that they can achieve maximum performance. Finally, an effective design for the kart is developed which can outperform the existing karts and also in the upcoming era of automobile vehicles.

Static analysis using finite element method was successfully carried out to determine maximum deflection, stress and its location on chassis structure. The results of analysis revealed that the location of maximum deflection and stress agrees well with theoretical maximum location of simple beam.

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