DESIGN AND STRUCTURAL ANALYSIS OF TRI POWERED GO KART

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Abstract: *From the beginning of our civilization, automotives have been always all integral part of the society, bicycles or what we commonly called cycles is the primitive stage of all automobile. The term Effie-cycle stands for what we called all efficient cycle or hybrid cycle. It is the special kind of vehicle which works by the engine, solar energy and also moves with pedals with higher efficiency than the normal bicycle which has the maximum efficiency and increase in magnitude is almost impossible. In regard to the recent surge of development in the automotive industry, and the growing need for alternative energy source for mobility in day to day scenario. This project carried aims at providing an energy efficient human powered four wheel electric vehicles capable of carrying two passengers. All the features like engine, drive train, suspension, brakes, steering, battery, solar panel, pedals, frame structure; etc has been designed to comply with the requirements. This paper aims to the design and analysis of a go-kart. The main intention is to do modeling and analysis of go-kart. The maximum deflection is obtained by analysis. The go-kart is different from ordinary cars on the road. The paper highlights the material used and structural formation of chassis. The strength of material, rigidity of structure and energy absorption characteristics is discussed. The modeling and analysis are performed using 3D software such as Catia and Ansys. The loads are applied to determine the deflection and stress of vehicle.*

I- INTRODUCTION

The Go Kart Project is a part of Engineering and is intended to be the capstone for the engineering program. It is a month long project where teams of two groups completed an engineering design project from concept to prototype. Students are able to select their own teams as well as the endeavor they would like to undertake.

The goal of two Teams is to complete the tasks necessary to developing a Go Kart. The components of this project that need to be selected or designed include:

- Frame
- Wheels
- Steering
- Seats
- Brakes
- Drive train
- User interface
    - Electric motor

- Dynamo
- 2 bicycle pedals
- 2 Solar panels

Requirements for the project were based on commonly available parts and on what the vehicle would be used for. The use for the vehicle will be recreational, most likely at resorts or vacation spots. A list of the requirements for the project is below:

- Four wheels
- Two person capacity with two seats
- Storage compartment
- Minimize the weight of the frame
- Common bicycle components used in the drive train
- Comfortable seating
- Intuitive to use

II - DESCRIPTION ON PROJECT

Solar System

Types of Solar Panels

Solar panels today have become more efficient than they used to be before and are continuing to be increasingly efficient day by day. There are now different types of solar panels available, namely, mono crystalline silicon, polycrystalline silicon, and Amorphous Silicon 'thin film' modules.

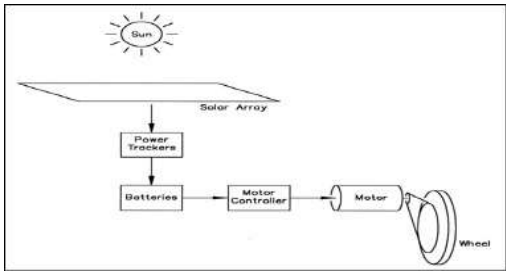

Fig: Working of Solar Panel

An electric motor is an electric machine that converts electrical energy into mechanical energy through electromagnetic interactions. Some electric motors are reversible, since they can transform mechanical energy into electrical energy to operate as generators.

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Battery

A battery is a container consisting of electrolytic cells in which two different metal electrical plates (cathode and anode) are separated by an ionic solution which is the medium capable of conducting electrons between the two plates. These elements are contained in a metal or plastic container, with separators of the active elements such as paper or cardboard, construction aids such as lead or cadmium or mercury improve the stamping limiting corrosion, in addition to elements of presentation.

The function of a battery is based on the fact that metals have different levels of electrode potential. With batteries, the term potential means that two metals like zinc and copper differ in their chemical ability to release electrons. The elements can be arranged in a electro-chemical series on the basis of this chemical property. Zinc releases electrons easily. This means it is easy to oxidize. Copper does not give up electrons for a chemical reaction so easily. This means it is more difficult to oxidize.

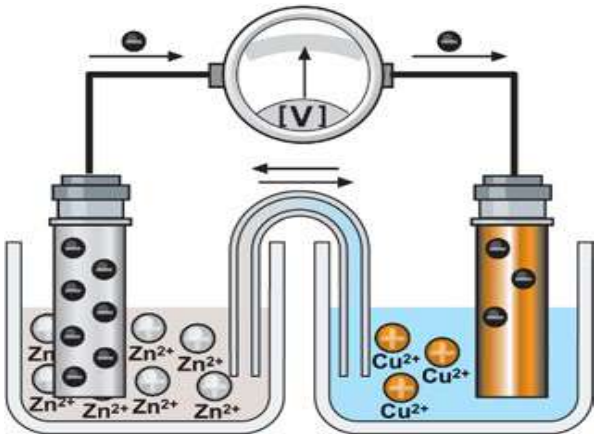

Fig: function of a battery

If you connect both electrodes with a conductor, the electrons will flow from the anode to the cathode. This set-up is generally called a galvanic cell and is the simplest form of a battery. If energy is released from the battery, the anode is the minus pole. In rechargeable batteries, the same electrode can alternately work as the anode or cathode depending on whether the battery is being charged or discharged.

Fuel Powered System

Fuel-based cars not only threaten the very air we breathe in but also the cost of running and maintaining them are huge and overbearing, and as the fossil fuels are gradually being depleted, the cost of these limited scare resources, the existing fuels' prices are continuously rising. Clearly, individuals need to become more aware of the consequences of their actions and can help protect the earth by using an alternative method of transport, perhaps the solar car, an eco-friendly, clean, inexpensive, compact car, independent of fossil fuels and toxic emissions. This electric vehicle may definitely be a major step in reducing traffic congestion, noise and vehicle emissions on the

road. Solar cars would not contribute to global warming or to the production of CO_2.Thus this will reduce greenhouse gas emissions as CO_2 is the primary greenhouse gas and thereby lower human health risks.

Chain linkage

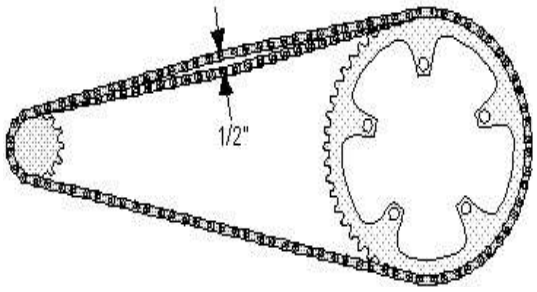

Fig: Chain linkage

The chain should have 1/2" of free play when the crank has been rotated to the point that puts the chain under the most tension.

Chain was chosen for the final drive. Because the length of the chain is not steeples, a chain tensioned has to be designed. To have the chain under the right tension prevents the chain from excessive wear and from the possibility to hop of the sprockets during driving.

Final Assembly

Finally, the drive train and motor were assembled and mounted within the frame of the rickshaw, within narrow space constraints. Slotted mounts for the motor and each axle allow the chains to be tensioned sequentially, from the rear axle all the way to the motor. Angle iron and steel flat stock welded to the frame provide the mounting system and support for the drive train, which is particularly stiff between the two hub axles to prevent them from pulling together.

III - LITERATURE REVIEW

Material Selection Methodology for a Go-kart Chassis using FEA and Weighted Decision Matrices; Performance enhancement in automobile parts is usually focused on design optimization, but a periodic investigation into the material used can provide significant increments as well. This ideology is explored deeply in this paper as the material selection process of a go-kart chassis is demonstrated in the form of load calculations, property comparisons, and finite element analysis. The philosophy behind setting priorities in terms of mechanical properties and finite element analysis results is also discussed. The results are compared using a weighted decision matrix to ensure a balanced decision. This method of comparison can be divided into 3 steps where first, the properties are given weight age, followed by scoring and calculating a cumulative score for each material in correspondence with the criteria considered. These scores were then used to compare all the materials. The material

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selected based on the result improved the performance of the chassis in terms of safety and performance in a student competition.

Design and Fabrication of Go-Kart; The Go-Kart is a simple, lightweight, compact, and simple-to-run car. Unlike other vehicles, the go-kart is specifically built for racing and has very little ground clearance. Engine, wheels, steering, tires, suspension, and frame are the most common components of a go-kart. Due to the go-poor kart's ground clearance, no suspension can be mounted. (CHAUHAN, 2016) Go-karts are primarily used in racing; that's why for the maximum acceleration of these vehicles, it is mandatory to reduce its weight—the cars have low acceleration and high torque. But in the case of racing, the driver always needs a less-weight vehicle so that it will cause an increase in speed. Because of its ease, low cost, and safer way of driving, go-karts are a perfect choice for those involved in racing. The go-kart track is similar to an F1 racecourse. Go-karts can be approved for use on public roads in certain countries. A go-kart on the street in the European Union, for example, must have headlights (high/low beam), taillights, a whistle, markers, and a limit of 20 horsepower.

Design and Analysis of Go-kart Chassis using CATIA and ANSYS; A Go-Kart is a small four-wheeled vehicle without suspension or differential. It is a light powered vehicle which is generally used for racing. This work is aimed to model and perform the STATIC analysis of the go-kart chassis which is of constructed with circular beams. Modeling and analysis were performed in CATIA and ANSYS respectively. The go-kart chassis is different from ordinary car chassis. Here two different materials were compared with Circular models. Suitable materials were found to be AISI1018 and carbon fiber. By using front, rear side-impact methods, the chassis is designed in such a way that it requires less material and ability to withstand loads applied to it. Strength and light weight were the basic considerations for choosing the chassis material. Carbon fiber is the suitable material to be used for the go-kart chassis because of High Strength to weight ratio, Rigidity, Corrosion resistance, Electrical Conductivity, Fatigue Resistance. Based on stresses and deformation values.

IV - DESIGN METHODLOGY OF TRI POWERED GO KART

The concept of CATIA V5 is to digitally include the complete process of product development, comprising the first draft, the Design, the layout and at last the production and the assembly. The workbench Mechanical Design is to be addressed in the Context of this CAE training course.

3d model and 2d drawing model is shown below for reference. Dimensions are taken from. The design of 3d model is done in CATIA V5 software, and then to do test we are using below mentioned software’s.

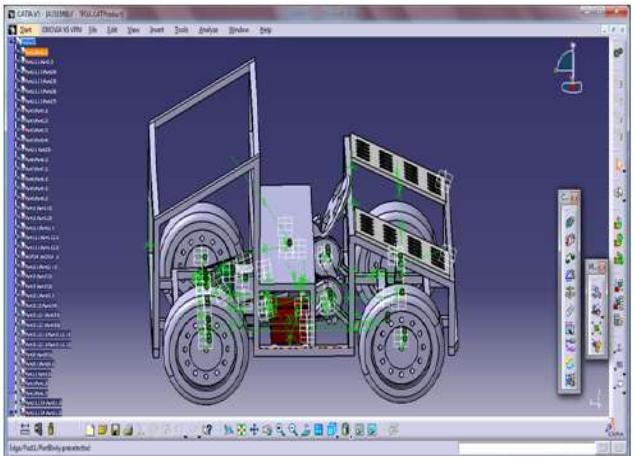


Fig: Model design of Tri Powered Go Kart in CATIA-V5

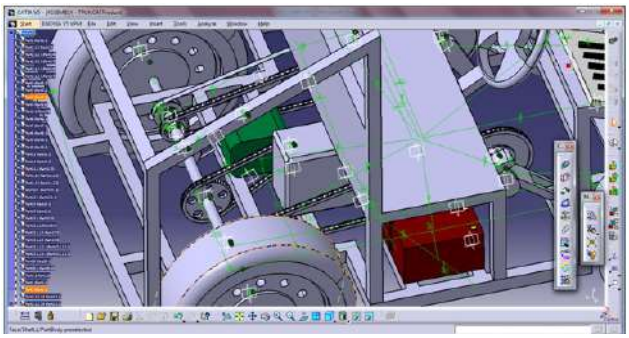
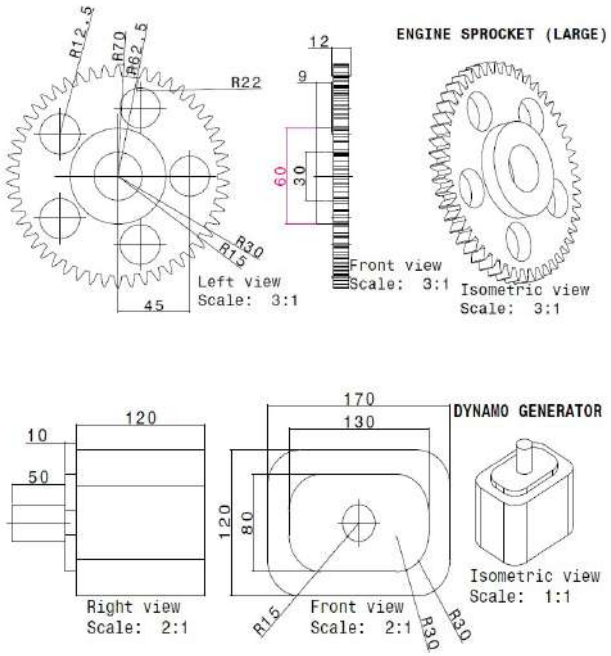


Fig: Model arrangement of mechanism in CATIA-V5

2D Drawings of Tri Powered Go Kart



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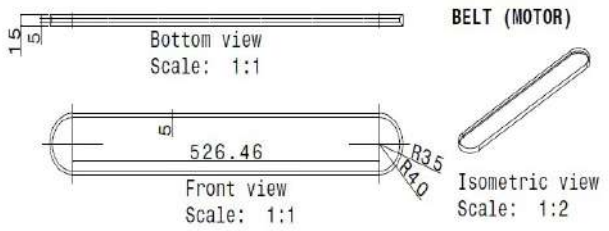
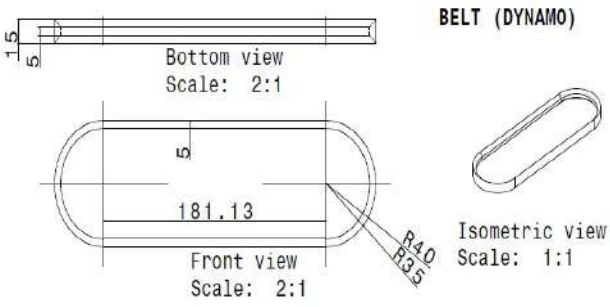

BELT (MOTOR)
15
5
Bottom view
Scale: 1:1
5
526.46
R3.5
R4.0
Front view
Scale: 1:1
Isometric view
Scale: 1:2


BELT (DYNAMO)
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Bottom view
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181.13
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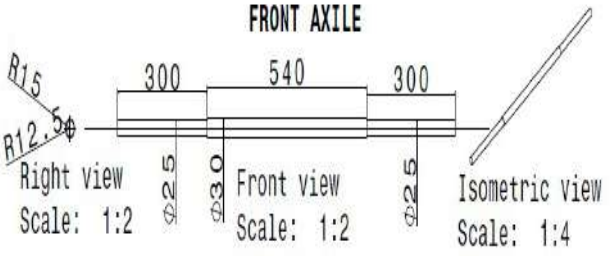
R3.5
Front view
Scale: 2:1
Isometric view
Scale: 1:1


FRONT AXILE
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Front view
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Isometric view
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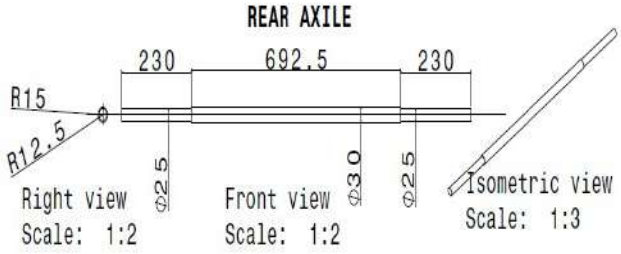
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Front view
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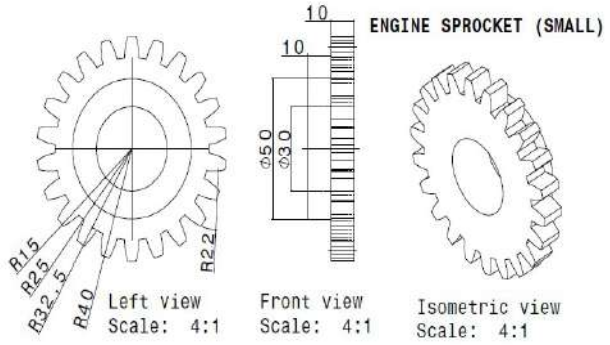

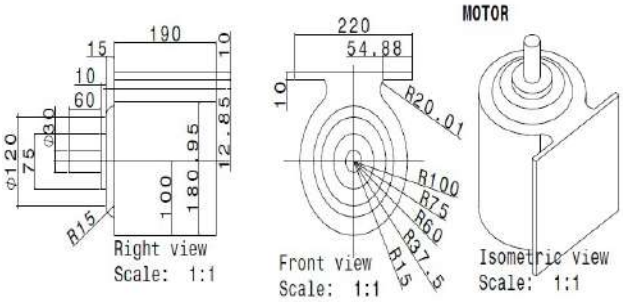

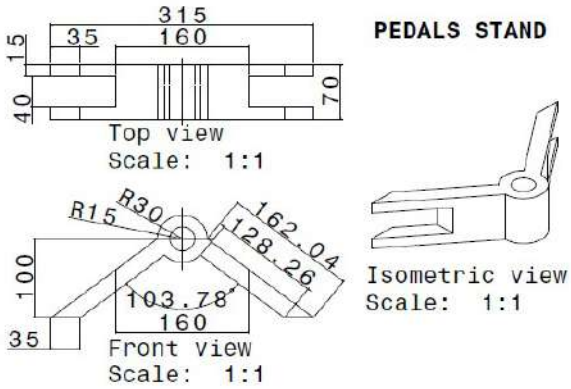

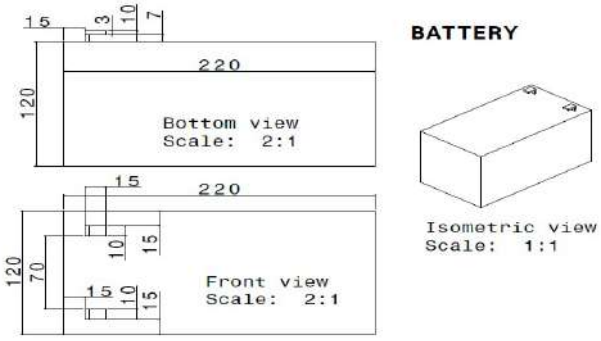

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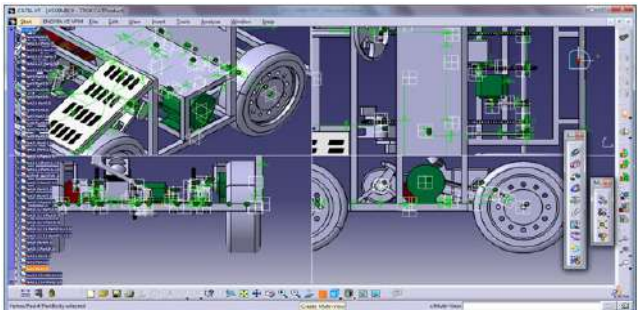

Fig: Using Multi View Command

V - ANALYSIS OF TRI POWERED GO KART

Procedure for FE Analysis Using ANSYS:

The analysis is done using ANSYS. For compete assembly is not required, motor and attached system is to carried out by applying moments at the location along which axis we need to mention. Fixing location is bottom legs of assembly of the craft.

Preprocessor

In this stage the following steps were executed:

- **Import file in ANSYS window**

  File Menu > Import> STEP > Click ok for the popped up dialog box > Click Browse" and choose the file saved from CATIAV5R20 > Click ok to import the file

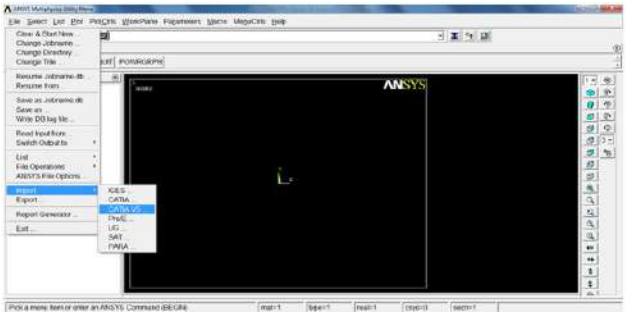

Fig: Import panel in Ansys.

VI - DISCUSSION ON ANALYSYS RESULT

Results of Displacement analysis:

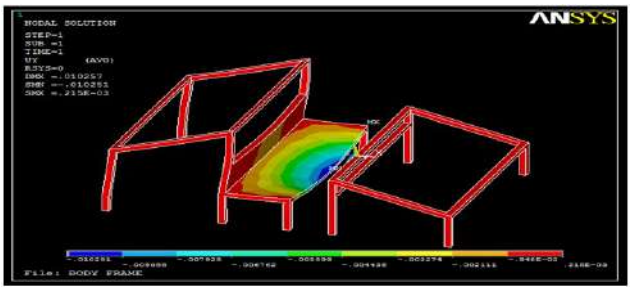

Fig: Displacement of Body Frame

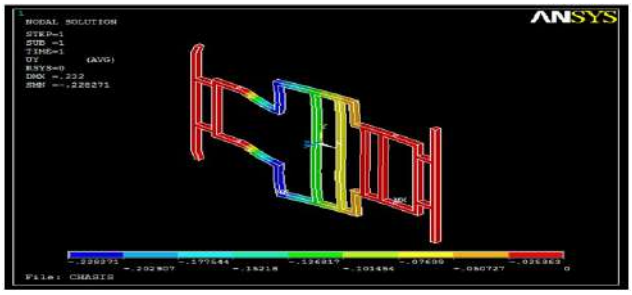

Fig: Displacement of Chassis

Results of Stress analysis:

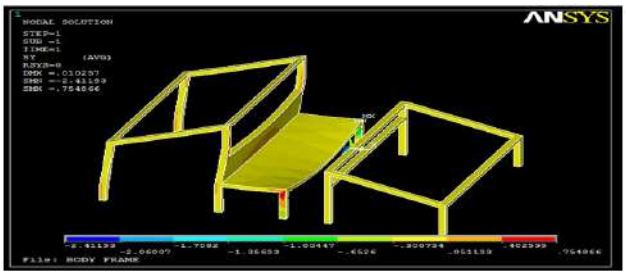

Fig: Stress of Body Frame

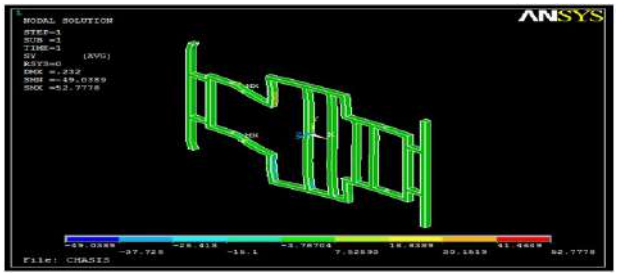

Fig: Stress of Chassis

Results of Strain analysis:

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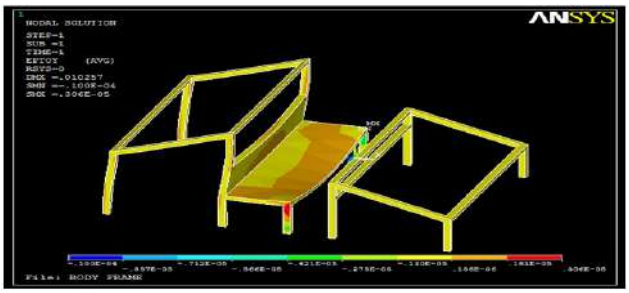

Fig: Strain of Body Frame

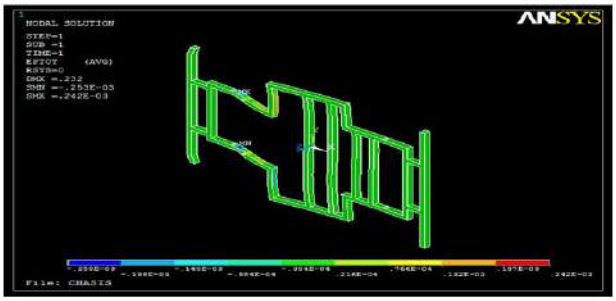

Fig: Strain of Chassis

VII - CONCLUSIONS

A highly nonlinear model for the dynamic behavior of Tri Powered Go Kart is considered. A parametric study to investigate the influence of the control parameters on the structural strength response is conducted. The control parameters that influence the structural response are found to be dimensionless equation is developed to predict the response. Based on the developed equation, the Optimum values of the control parameters of the Tri Powered Go Kart are obtained.

As shown in above figures the Strains of the components is meshed and solved using Ansys and Strain is very less. This is showing us that clearly each component in gear assembly is having minor Strain. Strain is at the fixing location (Minimum Strain which is acceptable). The value which is very less compared to yield value of given materials; this is below the yield point.

Table: Structural Analysis Results

S.No	Description	Body Frame	Chassis
01	Max. Displacement (in mm)	0.215E-03	0.228271
02	Max. Stress (in MPa)	0.754866	52.7778
03	Max. Strain	0.306E-05	0.242E-03

The final result positive manner .There is no problem while in Final assembly design; without failure. For proving that above analysis is carried out for applying Strains and rotational force analysis. Clearly there is no shortage of Tri Powered Go Kart development in the future. As the technology is taking off in various forms, the Tri Powered

Go Kart is well on its way to clear the path for future vehicle transport. Although new vehicles are low in noise, a problem that plagued earlier developments most engines used are still gasoline-based. It seems only a matter time before that they will appear on our streets.

Finally, I report that assembly design is fine and finite element model results shown same results. There is no failure in analysis.

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