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Design Fabrication And Analysis of Tri-Wheeled Electric Vehicle

U.Jawahar Surendra[1], JV.Mohanachari[2], C.Subhahan Basha[3], B.Anjaneyulu[4], Dr.G.Nagamalleswara Rao[5]

[1](Lecturer ,SK University ,Ananthapuramu)
[2](Assistant Professor ,Gates Institute Of Technology, Gooty, Anantapur,A.P.)
[3] (Assistant Professor ,Gates Institute Of Technology, Gooty, Anantapur,A.P.)
[4] (Assistant Professor ,Gates Institute Of Technology, Gooty, Anantapur,A.P.)
[5](Professor & Principal , Gates Institute Of Technology, Gooty, Anantapur,A.P)

Abstract: *In daily life we can observe the difficulties of carrying the patients, old people, physically handicapped in public places like airports, railway stations, bus stands, hospitals, college campuses etc. To aid such people we prepared an electric tri-car to ease the task of carrying them. Moreover, it is a multipurpose vehicle to carry pilgrims in pilgrim places, to carry inspection teams in industries, estates or campuses etc. The seating arrangement of this tri-car is such a way that the disabled can easily get into the vehicle and also get down. This tri-car is designed and analyzed with the help of the soft ware called PROE. Then analysis is done in Statistical and Modal Analysis. We modeled and fabricated a tri-car into a three wheeled electric powered vehicle with three seats and can accommodate two pillions and a driver. We designed the vehicle to be propelled by an electric hub motor mounted in the front wheel and powered by 48V Lithium-ion battery.*

Keywords - *Pro E, ANSYS, Composite Material, structural and modal analysis*

I. INTRODUCTION

In an era where energy conservation has become the latest topic of discussion not only among erudite but also among the ordinary responsible denizens, for efficiency along with minimum pollutions has become the benchmark for any new automobile and in the same context "TRI WHEELED E-CAR " come as the latest addition. By the name itself it can be inferred that a Tri Wheeled E_CAR is powered by electric batteries. Anyone thinking about the nature and future understands the electric cars are attractive compatible. With all concerns on heavy taxes on fuel, and the possibility of further restrictions on greenhouse gas emission, work on alternative power systems for vehicles is very important. We seen that most cars only travel with one or two person in it, no matter how small or big the car is. They are the people, who could save the world by driving a TRI WHEELED E-CAR".

The project title as "Fabrication And Running Cost Analysis of Tri Wheeled E-Car" is aimed to implement the most efficient and less polluting vehicle. In our project the electric car model whose motion is provided by electric motors. The motion may be provided by wheels by rotary motors, resulting to achieve the better fuel & pollution economy vehicle. We implement this electric vehicle concept for 4 wheelers**.**

II. PROCEDURE

Importing the Model

In this step the PRO/E model is to be imported into ANSYS workbench as follows:
In utility menu file option and selecting import external geometry and open file and click on generate. To enter into simulation module click on project tab and click on new simulation.

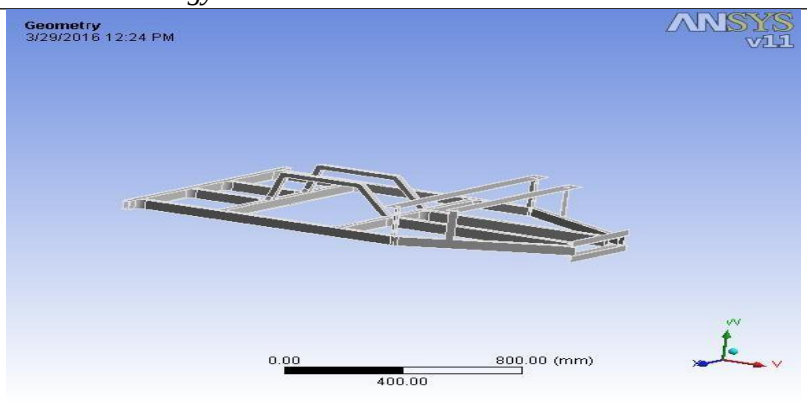


Figure 2.1 Importing Model

Defining Material Properties

To define material properties for the analysis, following steps are used.The main menu is chosen select model and click on corresponding bodies in tree and then create new material enter the values again select simulation tab and select material

Defining Element Type

To define type of element for the analysis, these steps are to be followed:
Chose the main menu select type of contacts and then click on mesh-right click-insert method
Method - Tetrahedrons
Algorithm - Patch Conforming
Element Mid side Nodes – Kept

Meshing the Model

To perform the meshing of the model these steps are to be followed:
Chose the main menu click on mesh- right click- insert sizing and then select geometry enter element size and click on edge behavior curvy proximity refinement and then right click generate mesh.

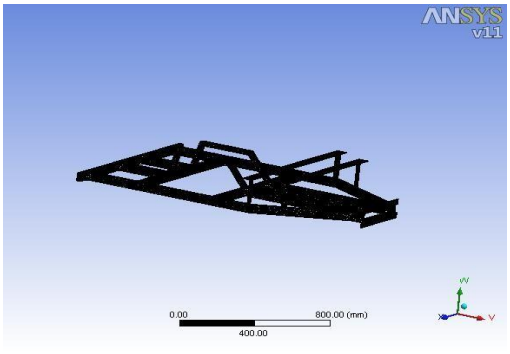


Figure: 2.2 Meshing Model

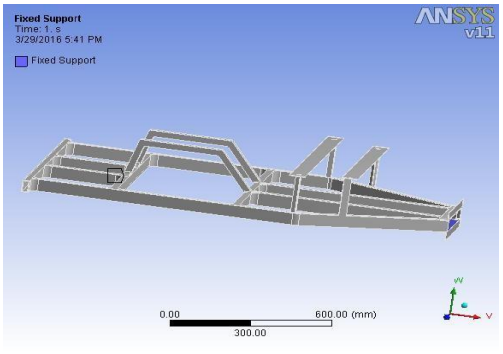


Figure: 2.3 Fixed Support

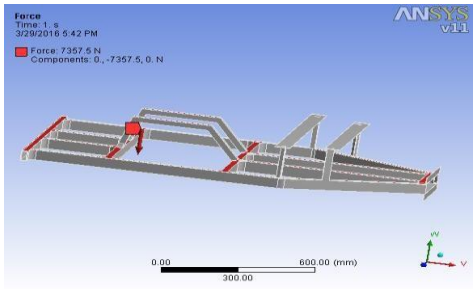


Figure: 2.4 Force Applied

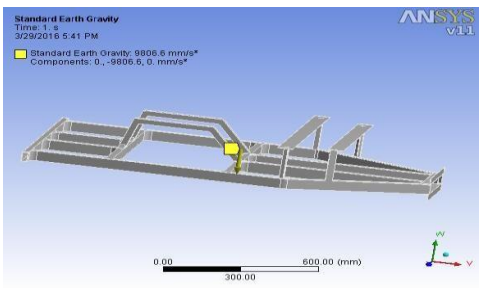


Figure: 2.5 Standard earth gravity

Material composition : Range of Compositions for Typical Unalloyed Cast Irons

Percent (%)					
Type of Iron	**Carbon**	**Silicon**	**Manganese**	**Sulfur**	**Phosphorus**
Cast iron	1.8-3.6	0.5-1.9	0.25-0.8	0.06-0.2	0.06-0.2

young's modulus: 1.1e+005Mpa
Poisson Ratio: 0.28
Density: 7.2e-006kg/mm3

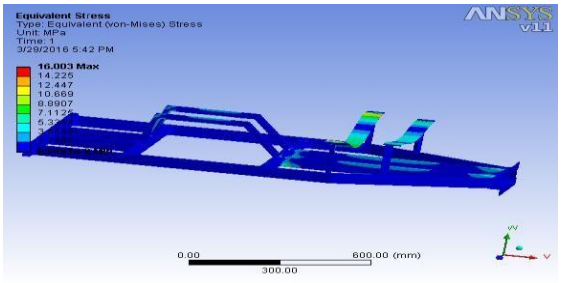


Figure:2.6 Equivalent stress

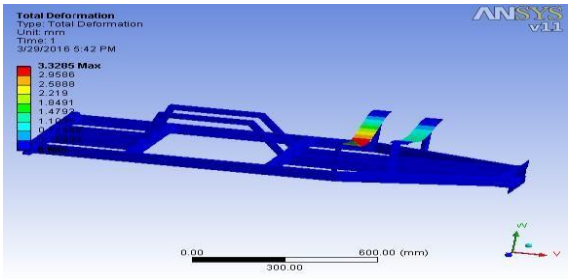


Figure: 2.7 Total Deformation

Modal Analysis

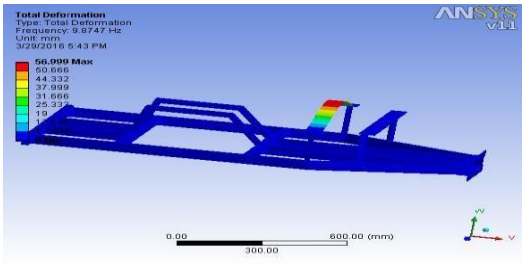


Figure: 2.8 Mode1

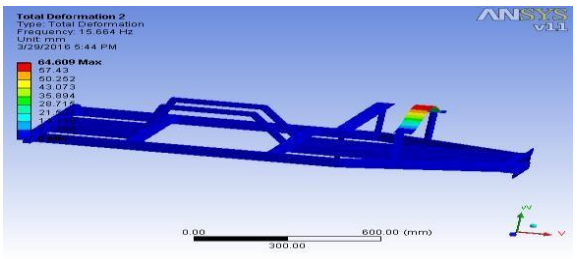


Figure: 2.9 Mode 2

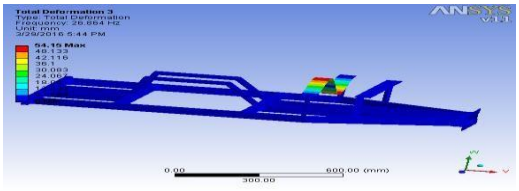
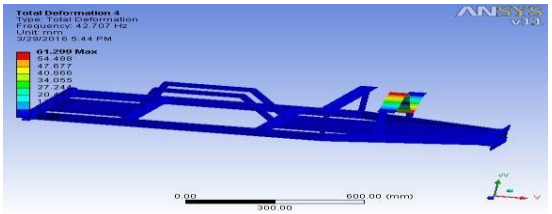


Figure: 2.10 Mode 3



Figures: 2.11 Mode4

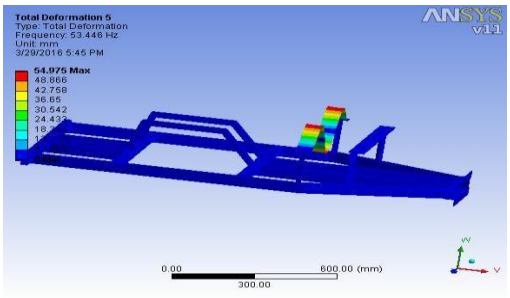


Figure: 2.12 Mode 5

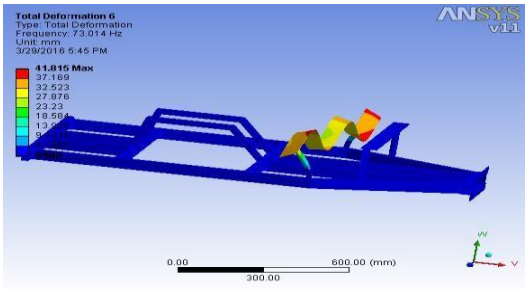


Figure: 2.13 Mode 6

Structural Analysis

Material	Deformation(mm)	stress (n/mm^2)
Cast iron	3.325	16.003

Modal Analysis

Modes	**Frequencies(HZ)**
1	9.87
2	15.85
3	26.81
4	42.70
5	53.44
6	73.01

III. CONSTRUCTION DETAILS OF TRI WHEELED E-CAR

An electric car is a battery operated vehicle that is very economical with low maintenance cost and zero pollution. Electric car use the electrical technology of rechargeable battery that converts the electrical energy into mechanical energy. The battery of an EV can be charged easily using a power connection.

The Construction Details Of Tri Wheeled Electric Car are Briefly Explained As Below:

The Tri Wheeled electric car mainly consists the power of an electric motor along with batteries system. The batteries are main sources gives the electric car. The dimensions of Tri Wheeled electric car are 1700mm length & 915mm width with suitable height and the system of rear wheel drive. In the rear wheels one is drive wheel and another is dame wheel.

There is control unit for controlling the speed of the motor .The batteries are arranged in the rear portion under the sitting sheet of electric car. The batteries are charged with the help of electric charger from the electric switch board. After the completion of charging process the charger is removed from the switch board.

The kingpin system is introduced in front axle for the purpose of to turn the Tri Wheeled electric car in some angle the steering wheel is attached to the steering is stanched and the electrical two wheeler wheels are attached

on both side of axle with certain distance and also shock absorbers are arranged inside the wheels for absorbing shocks or dampers produced by vehicle when it is travel in non uniform way.

Figure below shows an Tri Wheeled electric car, which has a set of batteries that provides electricity to an electric motor. The motor turns a transmission, and the transmission turns the wheel

3.1 Construction model

3.2.constrion model 2

IV. COST ANALYSIS ON TRI WHEELED E-CAR

Cost Analysis

An ordinary conventional car(NANO_CAR) available in the market Worth an rupees of 1,20,000/-.
The Tri Wheeled Electric car can be available if it is produced with the ordinary 1000w e-scooty power wheel worth's an rupees of 35,000/-.
Below the part to part cost is listed:

S.No	COMPONENT NAME	EXPECTED COST (Rs)
1	Battery pack	11,500
2	Hub motor	5,000
3	Extra wheels	2,000
4	BLDC controller	1000
5	Electric charger	800
6	Brake system	800
7	Chassis (work, Material)	6,000
8	Steering system	2,000
9	Wiring with cables	1,000
10	Accelerator	900
11	Accessories	1000
12	Lighting system	1,000
13	Seating System	2,000
	Total cost:-	35000

According to the above mentioned price a tri wheeled electric car can be available if any enterprise wish to produce & sell.

Running Cost Analysis

Running Cost For Electric Car

1.The time taking for full charging of 4 batteries is T= 12 hours
2.The current consumed for full charging of a battery is X=1.5 units.
3.The total current consumed for full charging of 4 batteries is N=4*X=4*1.5=6 units
4. unit cost = 3 rupees.
5.6 units cost = 6*3 = 18 rupees.
6.The approximate cost for full charging of 4 batteries is=18 rupees.
7.By using of full charged batteries the distance travelled by the vehicle is=45km.
8.Then, the running cost for electric car for travelling 45km is 18rupees only.
The annual running cost is =6,480+18,400 =24,880/-

Running Cost For Conventional Car (Nano-Car)
1.1 litre petrol cost = 78 rupees.
2.By using of 1 litre petrol the distance travelled by the NANO-CAR is 25km.
Then, the running cost for conventional car (NANO-CAR) for travelling 45km is 124.8 rupees.
By comparison of the two statements the running cost of the electric car is very less to the convectional car. The annual running cost is = 44,928/

V. RESULTS AND DISCUSSIONS

By this we conclude that TRI WHEELED ELECTRIC CAR means, POLLUTION LESS and Fuel Saving Technology for the Current and Future Vehicles" with even better efficiency & conservation rate are very much on the anvil in today's energy. High Cost/Price is still a big issue to be solved. This problem can only be eliminated by Collaboration between industries and government to lower the barriers costs (such as taxes) on the customer and industries to adopt these Eco-friendly ELECTRIC car technologies.

Tri wheeled Electric cars are having a pollution-free and greener environment. Further, with their sleek aerodynamic design and ultra-light materials, these vehicles can achieve speed of approximately 30-32km/h. All in all, one can assured that electric vehicles are the vehicles of the future and will rule the automobile industry until the next generation of eco-friendly and fuel-efficient cars take their place.

At last, the "TRI WHEELED ELECTRIC CAR" is fabricated, analyzed different cost factors that influence the running & existing in present market. This car gives good economical results for overcome from some limitations which are present in ordinary conventional cars. Its existence in present market decreases 90% pollution, saves nearly 349 liters petrol per annum, saves Rs.20,048/- per annum when compared with ordinary conventional car running cost.

The substitution of electric cars for conventional vehicles results in a significant reduction in greenhouse gas emissions. There are also economic benefits. Put simply, because they cost less to run.
Finally we are saving the 70% of the fuel usage with that of the energy supplied to vehicle by the batteries. Because of which the pollution be controlled. "So usage of the natural resources in the well defined manner rather than that of the threatening means".

Structural and modal analysis is also performed on the chassis of a tri wheeled car with material such as Cast iron and the stress distribution and different types of mode shapes were observed

VI. CONCLUSION

This tri wheeled electric car is very suitable for handicapped pesrsons .As well as it is eco friendly that means no pollution will cause by using this vehicle. From the structural analysis we can observe that the deformation is 3.25 mm and there is a less stress inclusion about 16.003 N/mm^2. From the modal analysis we can observe the natural frequencies which are showing that cast iron is suitable for making the chassis of this proposed car .

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