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Optimized Design and Analysis a chassis of a Hybrid cycle

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Abstract—*The epicentre goal of the study is to design and analysis a chassis of a Hybrid cycle. It is a hybrid based platform that comprises the durable design of chassis and driver's safety requirement is the primary aim of this study. In order to accomplish this task, there is a different test can be carried out like Frontal impact, rear impact and side impact. The entire design was carried out by using Solid works software and analysis done by ANSYS 15.0 software.*

Keywords: *Hybrid cycle, Finite element analysis (FEA), Chassis*

1. Introduction

Rapid growth of population and the increased Mobility comes up with high price and needs personal transportation vehicles instead of walking. The environmental decay is due to vehicles combustion of fossil fuel and price hiking posing a threat to the existence [1]. To overcome this problem, it is a time to develop alternate and greener modes of transportation for a sustainable future. The Hybrid cycle was designed to be an electrically assisted, dual-human powered tricycle with a capability to carry two people. The chassis is the main component in charge of supporting vehicle's subsystems and taking care of the driver safety at all-time[2]. The chassis design needs to be prepared for impacts created in any certain crash or rollover. It must be strong and durable taking always into account the weight distribution for a better performance [3]. In this paper we created the virtual assembly of the Hybrid cycle based on the general requirement using a CAD modeling software solid works and the analysis was done using ANSYS15.0simulation software. Based on the

Fig.1 prototype model of hybrid cycle

Analysis the model was retested with boundary conditions under the practical parameters. So the design focuses on safety, serviceability, strength, ruggedness, standardization, cost, ergonomics and aesthetics. In this paper the detailed simulation and finite element analysis of the Hybrid cycle chassis is carried out

2. SELECTION OF MATERIAL

Material selection of the chassis plays a crucial part in providing the desired strength, endurance, safety and reliability to the vehicle. To choose the optimal material we did an extensive study on the properties of different carbon steel. We choose the material AISI 1020 with 0.12 to 2% of carbon is used in the frame design because of its good weld ability relatively soft and strengthens as well as good manufacturabilityThe material **AISI1018** with 0.18-2% of carbon and 0.9% manganese is used in the frame design because of its good weld ability relatively soft and strengthens as well as good manufacturability [4]. A good strength material is important in a roll cage because the roll cage needs to absorb as much energy as possible to prevent the roll cage material from fracturing at the time of high impact. MILD STEEL has chosen for the chassis because it has structural properties that provide a low weight to strength ratio.1 inch (25.4 mm) diameter tube with a thicker wall of 2 mm is used. Then it is also assured by analysis in solid works software. The various Physical properties of the material are as follow the

Table 1. Material properties of mild steel

S.No.	Properties	Values
01.	Tensile strength,	440 Mpa
02.	Tensile strength, Yield	370 Mpa
03.	Bulk modulus	140 Gpa
04.	Shear modulus	80 Gpa
05.	Modulus of elasticity	205 Gpa
06.	Poisson's ratio	0.29
07.	Elongation at break	15%

2. FINITE ELEMENT ANALYSIS

Finite element is a method for solving the approximate solution of physical problems involving complicated geometry, loading, material properties and partial differential equations such as: Solution of elasticity problems, Determined is placement, stress and strain fields, and transient dynamic, steady state dynamic and maximum deformation i.e .subject to sinusoidal loading, modes and frequencies of vibration, modes and loads of buckling [5]. The frame is analysed.

STATIC ANALYSIS

- Frontal impact
- Rear impact
- Side impact

A.FRONTAL IMPACT

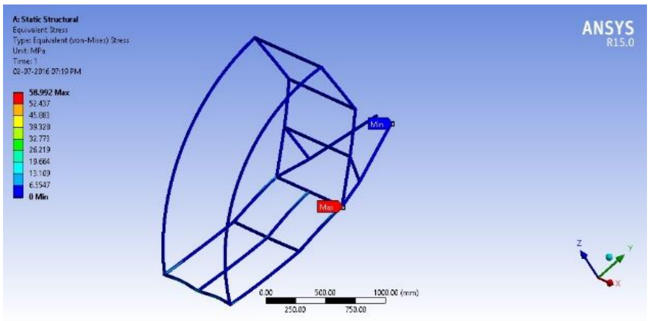

Fig2. Equivalent stress (front)

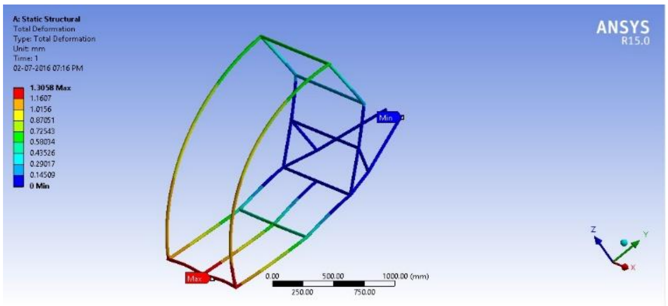

Fig3. Total deformation (front)

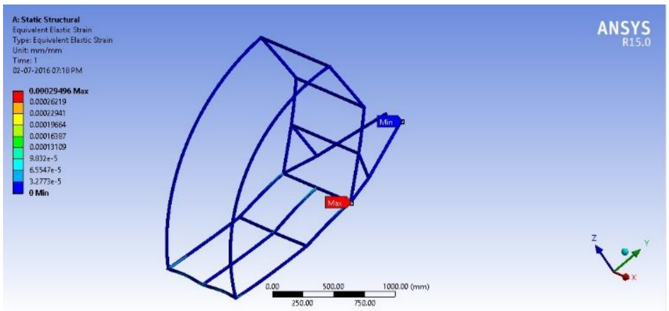

Fig4. Equivalent strain (front).

B. SIDE IMPACT

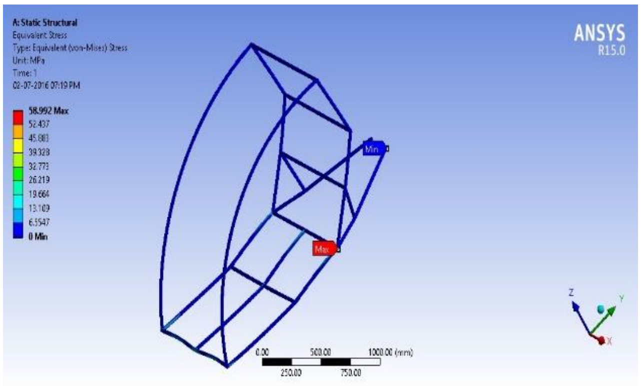

Fig5. Equivalent stress (side)

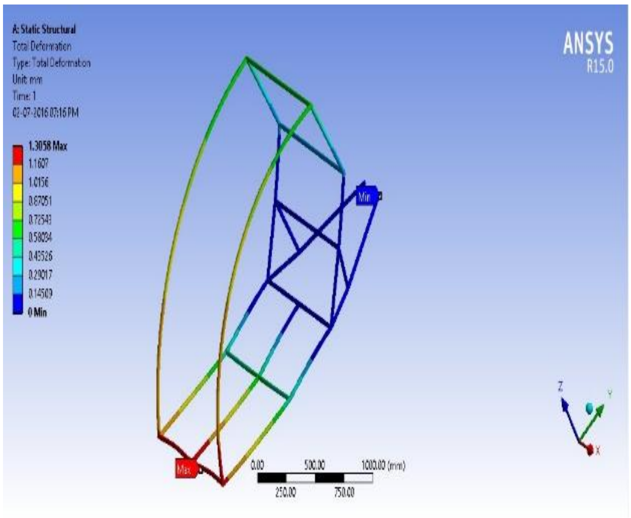

Fig6. Total deformation (side)

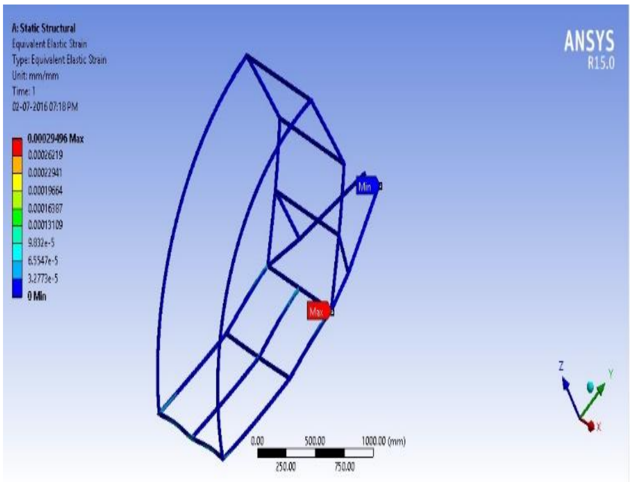

Fig 7. Equivalent strain (side)

C. REAR IMPACT

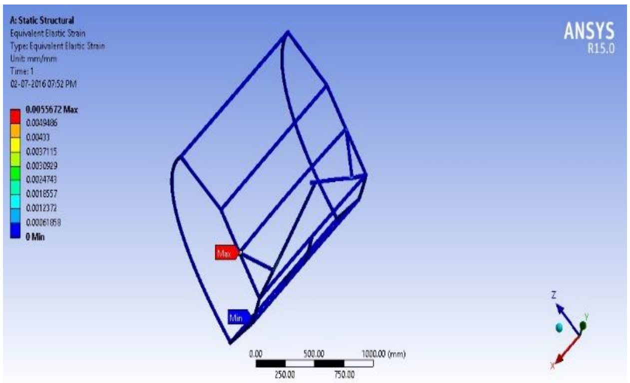

Fig8. Equivalent stress (rear)

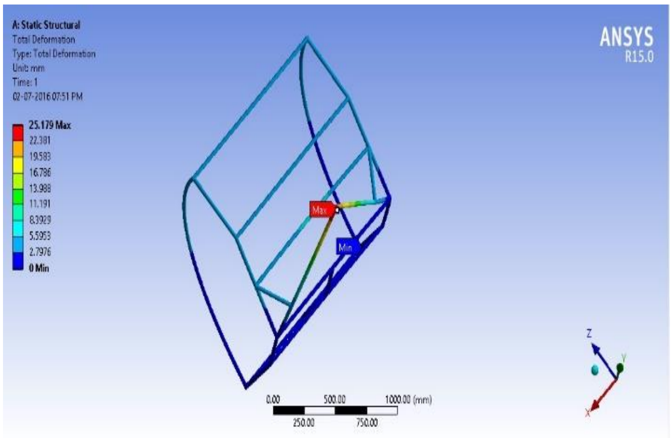

Fig9. Total deformation (rear)

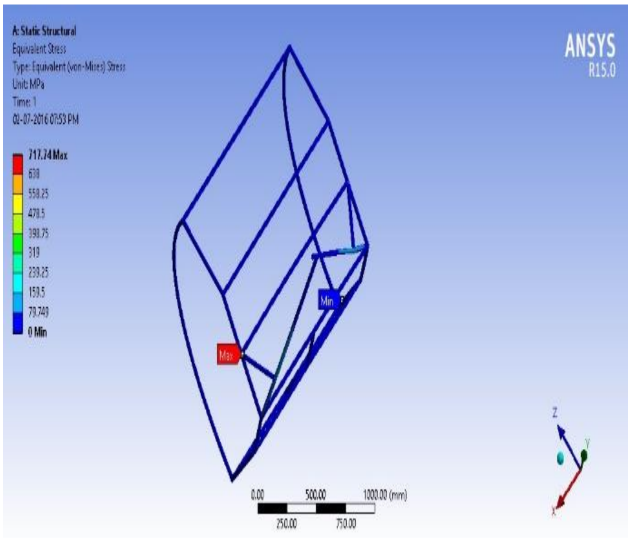

Fig10. Equivalent strain (rear)

RESULT

Case	FRONTAL IMPACT	REAR IMPACT	SIDE IMPACT
Forces	6g	4g	4g
Maximum stress(mpa)	58.9	0.00294	1.3
Maximum strain (mm)	59.8	0.0032	2.5
Maximum deformation (mm)	59.5	0.0011	1.3

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CONCLUSION

The Structural Analysis of Chassis shows that the maximum equivalent stress is less than the Yield Strength of the 1018 Mild Steel. The distributions of the stress that acting on the chassis and critical area that will lead to failure is also observed. The proposed analysis meets the driver's safety in all aspects.

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