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A Review on Fabrication and Working of Electric-Solar Vehicle

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ABSTRACT: The point of these examination paper is to cover all the outline parts of the planning and investigation of the fundamental sun oriented vehicle. Apart from this, it manages segments which are coordinated into the vehicle. It utilizes BLDC engine which is having supply of 1.5KW from lead corrosive battery. It additionally incorporates rack and pinion guiding mechanism, Hydraulic compose breaking framework and furthermore twofold wishbone 'A' type suspension framework.

KEYWORDS: Preliminary solar vehicle, BLDC motor, lead acid battery, rack and pinion, hydraulics, double wishbone, chassis design, Battery, Motor.

I. INTRODUCTION

ESVC (Electric Solar Vehicle Championship) is an occasion composed by ISIE INDIA (Imperial Society of Innovative Engineers) for upgrading and executing their viable information by planning and manufacturing Electric Solar Vehicles keeping in mind the end goal to rival the understudies which are taking an interest in the occasion. This paper primarily focusses on the challenges looked by the understudies while performing counts and planning of different parts of the Electric Solar Vehicle.

II. CONTENT

Material Selection Process:

The carbon content in the steel is vital to decide the hardness, quality, machining and welding attributes. Material determination for body assumes an indispensable job in working up of whole vehicle in giving unwavering quality, wellbeing and continuance. The steel which has carbon expands the hardness of the material. Aluminum composite is costly than steel, all things considered steel is the most ideal material for manufacturing the chassis.

Composition of AISI 1018

Composition	AISI 1018
Iron	98.8 to 99.2%
Manganese (Mn)	0.6 to 0.9%
Carbon (C)	0.15 to 0.2%
Sulfur (S)	0 to 0.050%
Phosphorus (P)	0 to 0.040%

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Properties Of AISI 1018

PROPERTIES	AISI 1018
Density	7.9g/cm ³
Elastic (Young's, Tensile) Module	210GPa

Reports showing CAE simulation on chassis, along with calculation :

Front impact displacement:

Front impact was calculated for an optimum speed of 40 kmph. The loads were applied only at front end of the chassis because application of forces at one end, while constraining the other, results in a more conservative approach of analysis. Time of impact considered is 0.13 seconds as per industrial standards.

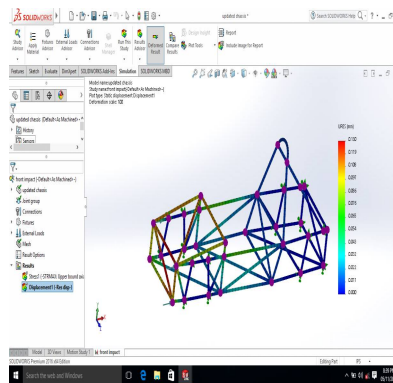
We know. According to Force work relation

$$\text{Work done} = \text{Force} * \text{Displacement}$$

$$\text{Force} = 9611.2\text{N}$$

$$\text{Displacement} = 1.08\text{m}$$

$$\text{Work done} = 10.3\text{KNm}$$



Rear impact displacement:

Considering the worst case collision for rear impact, force is calculated as similar to front impact for speed of 40 kmph. Load was applied at rear end of the chassis while constraining front end and king pin mounting points. Time of impact considered is 0.13 seconds as per industrial standards.

We know. According to Force work relation

$$\text{Work done} = \text{Force} * \text{Displacement}$$

$$\text{Force} = 4164\text{N}$$

$$\text{Displacement} = 2.499\text{m}$$

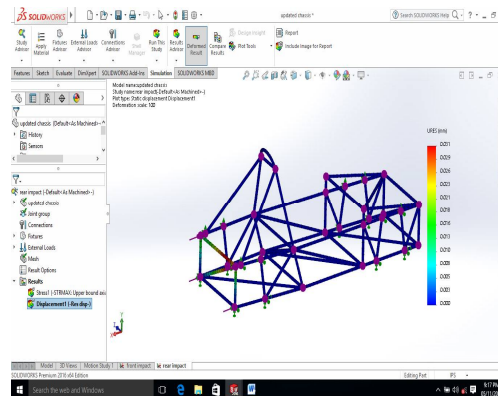
$$\text{Work done} = 10.4\text{KNm}$$

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III. CALCULATIONS

- BRAKES:**

The brakes are one of the most important control components of vehicle. The brakes should be designed such that it should stop the vehicle within minimum distance in an emergency with considering safety of driver and vehicle itself. This report elaborates the braking system of our solar vehicle. With the mathematical calculations we have designed the brake system.

Calculations:

1. Pedal Ratio = $A/B = 4:1$
2. Rotor Disc Diameter = 200 mm
3. Wheel base (b) = 1651 mm
4. Track width (c) = 1244.6 mm
5. Force applied by Driver (F_1) = 15 kg=147.15N
6. Velocity of vehicle (v) = 40kmph (Assumed optimum velocity)
7. Clamp load = 5.208 KN

- STEERING:**

The basic aim of steering is to ensure that the wheels are pointing in the desired directions. This is typically achieved by a series of linkages, rods, pivots and gears. When the driver turns the steering wheel, a shaft from the steering column turns a steering gear.

IV. ACKERMANN PRINCIPLE

Ackermann guiding geometry is a geometric game plan of linkages in the controlling of an auto or other vehicle intended to take care of the issue of wheels within and outside of a swing expecting to follow out circles of various radii. The Ackermann directing geometry that is connected to all vehicles to incapable the right turning edge of the guiding wheel to be produced while arranging a corner or a bend.

CALCULATIONS:-

- Wheel base = 1651 mm
- Track width =1244.6 mm
- Steering ratio = 6:1
- Camber angle = -2°
- Caster angle = 1°
- Ackerman angle = 20.65°

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Steering angle of inner wheel=35°
Steering angle of outer wheel =24.62°
Average of inner and outer wheel angles=28.98°
R1=2980.17 mm
Turning radius R = 3064.60 mm

- **Solar Panels:**

Solar Panels is basically “the most common way of harnessing energy from the sun through photovoltaic panels”. We are going to use Mono – crystalline Silicon solar cell in our vehicle . In front side we are going to use 40 solar cells and in rear side 5 solar panels .40 cells will be connected in series on the front and 5 solar panels in parallel on the rear of the solar car.

1 Solar cells Specification :

Voltage : 0.5 V
Current : 8 A

1 Solar Panel Specification :

Voltage : 10 V
Current : 0.5 A

Front of the car:

$$\begin{aligned} 1 \text{ solar cell : } P &= VI \\ &= 0.5 * 8 \\ &= 4\text{WH} \end{aligned}$$

Voltage obtained : 20 V
Power obtained : 160WH

Rear of the car:

$$\begin{aligned} 1 \text{ Solar panel : } P &= VI \\ &= 10*0.5 \\ &= 5\text{WH} \\ \text{Power obtained} &= 25 \text{ WH} \end{aligned}$$

- **ELECTRICAL:**

Motor:

An electronic motor is an electrical machine that convert electrical energy into mechanical energy.

There are 2 types of motors

- BLDC motor
- Hub Motor

We are going to use BLDC motor.

Specification :

Voltage : 48 V
No load current : 5A
Rated current : 45A
 $P=V*I$
 $= 2000/48$
 $=41.66 \text{ AH}$

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Battery:

An electronic battery is a device consisting of one or more electro cells with external connection provided to power electrical devices . It's positive terminal is the cathode and negative is anode .

Specification :

Weight : 18 kg

Dimension: 620 mm*300 mm*100mm

Pack of cells :

Voltage : 48 V

Current : 78 AH

1 cell :

Voltage : 3.2 V

Current : 2.6

- RESULT:
- **Chassis impact test:**

Front impact displacement:

Force =9611.2N

Displacement =1.08m

Work done = 10.3KNm

2. Brakes:

Braking force = 8867 N

Work Done in Braking = 15.428 KJ

Braking Power = 49.29 KWatt

4.Solar Panels:

Front of the car:

Voltage obtained : 20 V

Power obtained : 160WH

Rear of the car:

Power obtained : 25 WH

V. CONCLUSION

This paper focus on the design, analysis and calculation of various components that is necessary for fabrication of a Electric Solar Vehicle. We have performed various types of static analysis and applied different loading condition on the chassis and it if found to be safe according to their factor of safety. We also learn how to select appropriate material for the safe design of chassis. Successful analysis was perform on the chassis of CAD modal using ANSYS WORKBENCH to determine, equivalent stresses, and total deformation results. The type of steering system used is rack and pinion and all the calculation are done using Ackerman's principle. Detailed calculation of brakes is discussed in this paper and the maximum temperature is evaluated using software.



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