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Design & Analysis of Chassis of Solar Car

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Abstract- This paper aims to do modelling the static analysis of solar car chassis consisting of circular beams. Modelling and analysis are performed using 3-D modelling software & static analysis in CATIA . The maximum deflection is obtained by analysis. The solar car chassis is similar to ordinary cars on the road. The material used and structural formation of chassis. The loads are applied to determine the deflection of chassis.

Keywords: Chassis Modelling, Static Force Analysis, CATIA.

1. INTRODUCTION

Solar car can be categorized as a 'green vehicle' which is powered by renewable energy with zero carbon emission. Various numbers of solar race events organized around the world has propelled the continuous development of solar cars by different research teams. These events have become the platform for universities and private companies to showcase their latest technologies and findings in utilising solar energy to drive their vehicles. Solar car development cost has been observed to increase significantly over the years with most teams having the sole aim of winning the race at all costs, instead of producing a practical solar car suitable for everyday use. Bucking this trend, Centre for Product Design and Manufacturing has recently developed a solar car using off-the-shelf components in order to reduce the development cost. It presented a big challenge to the team in combining those components while aspiring to achieve optimum operating conditions. This paper describes the design concept of this 'alternative' solar car, the mechanical, electrical and telemetry systems and some performance characteristics of the car. During the recently concluded World Solar Challenge 2009, even though the developed solar car has managed to cover only 20 percent of the total distance required but managing to received positive responses due to its practicality, novel concept and comfort factors.

2. CHASSIS

The chassis of solar car was designed on the parameters to guide complete safety of rider as well as to maintain the feasibility of solar car for all loads applicable.

When designing the frame for a solar powered vehicle, many parameters are important to take into account. Since the high importance of low aerodynamic resistance (Roche et al,1997), the design space for the frame is quite complex. Furthermore, the frame has to meet the requirements for strength and stiffness in every load condition. Moreover, mounting points need to be provided to attach different components such as the battery package, electronics, body panels, etc.

2.1 Objectives

The objectives of this paper are follows-

1. To select suitable material for chassis.
2. To determine the maximum stress on chassis.
3. To determine the maximum deflection.

3. METHODOLOGY:

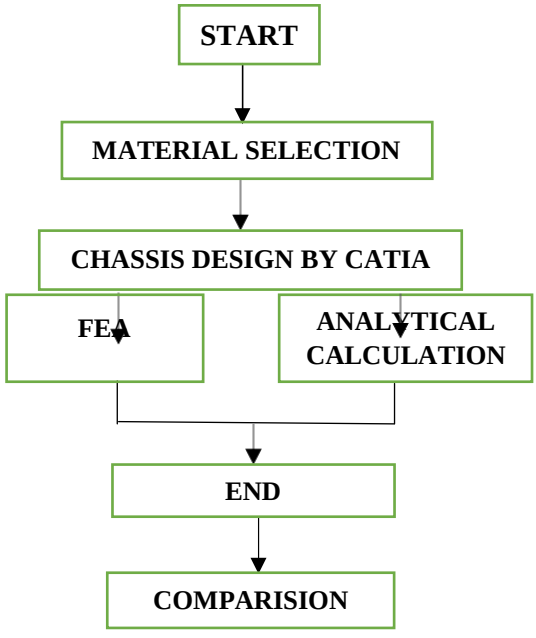

Chart 1: Flow Chart of Methodology

4. DESIGN

The chassis is designed considering the factors like factor of safety - maximum load carrying capacity,

The main component of the frame is divided into two major parts first the front block for steering and seat positions etc. and second rear block for transmission and brake assembly.

Force absorption capacity, required space for accessories and driver and specific dimensions.
The design of chassis is performed by using software such as CATIA. The load distribution in the chassis should be uniform. The structural design gives the idea about the chassis. Design gives the optimum shape and size of the chassis.

5. CAD Model of Chassis

The basis structure of chassis is created in CATIA :

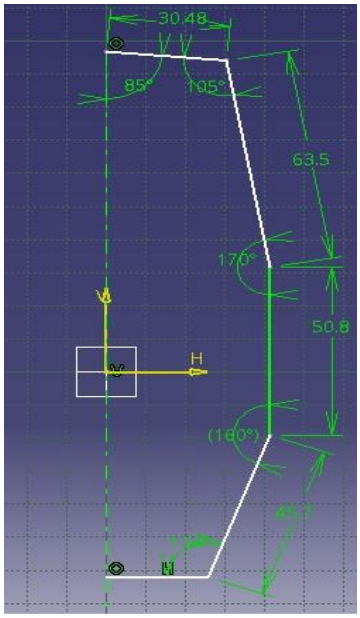

Fig 1: Basis structure

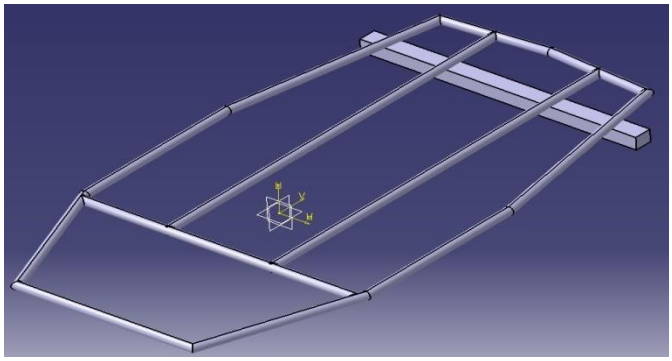

Fig 2 : 3D Model Of Chassis.

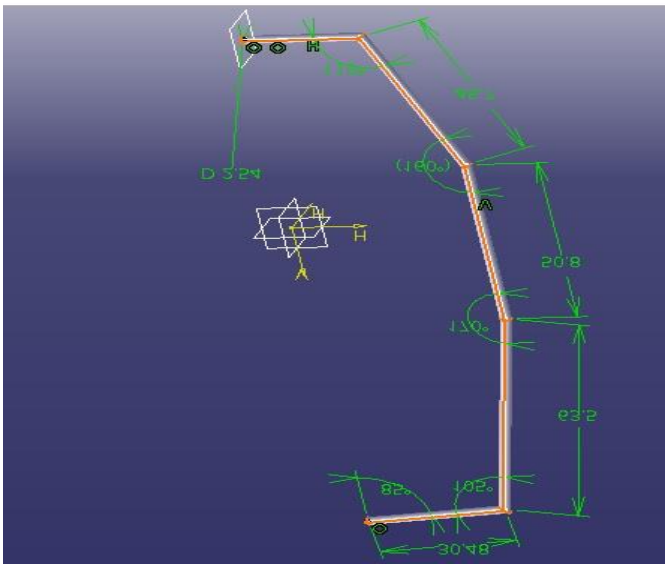

Fig 3: CAD Model

6. ANALYSIS

The next stage after design is analysis of chassis under various impact forces. The chassis experience loads under condition such as cornering force, torsional rigidity and overall dynamic loads applied during race. By performing

6.1 Meshing

Meshing is probably the most important part in any of the computer simulations, because it can show drastic changes in results.

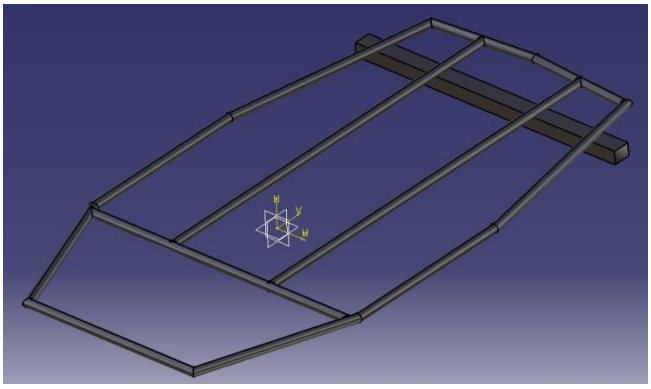

Fig4 : Meterial Implimentation.

6.2 Stress Analysis

Generally in the case of pure elastic collision in frontal impact analysis is done by apply force of 1962 N and the fix support is applied at front shaft, also it divided in four rods and at back side rod by Appling this boundary

condition's we get total stress deformation in static analysis-

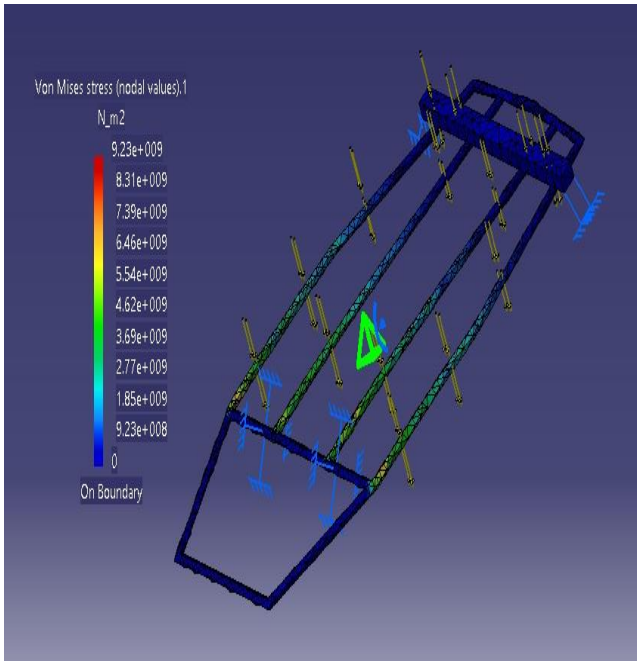

Fig: Von Mises Stress Diagram.

The above figure shows the Von Mises stress distribution obtained by FEA analysis of the chassis. One can note that Von Mises stress is at maximum towards the fixed end of the chasis, and the value is $9.23x10^9$ Pa.

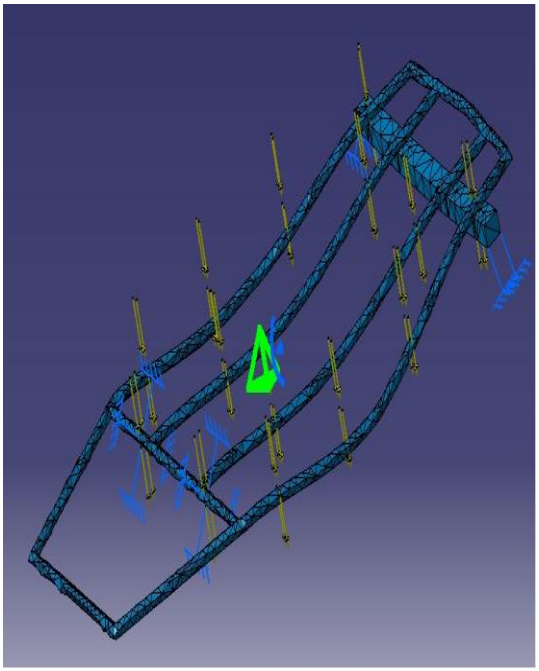

Fig:Deformation Diagram.

The above figure shows the deformation of the chassis of solar car after applying the load of 1962N.

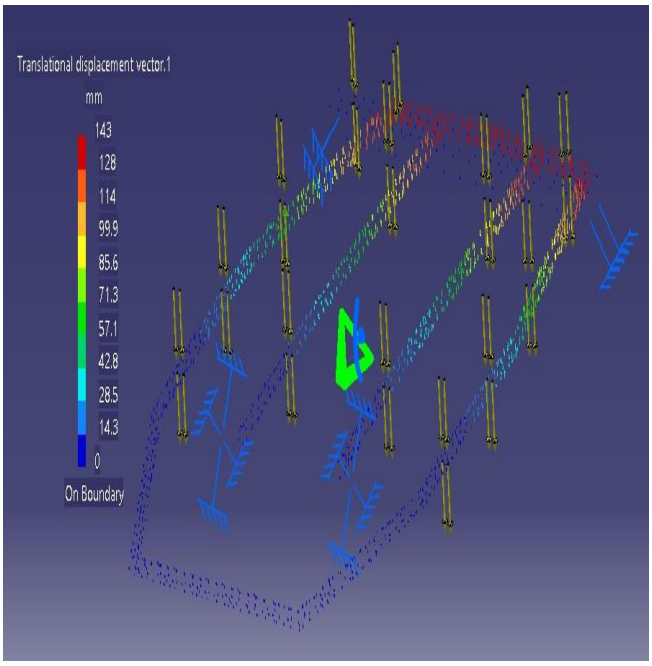

Fig: Tranlational Displacement Vector Diagram.

A plot of the displacement field is displayed with arrow symbols. If you go over the plot with the cursor, you can visualize the nodes. The computed displacement field can now be used to compute other results such as strains, stresses, reaction forces and so forth.

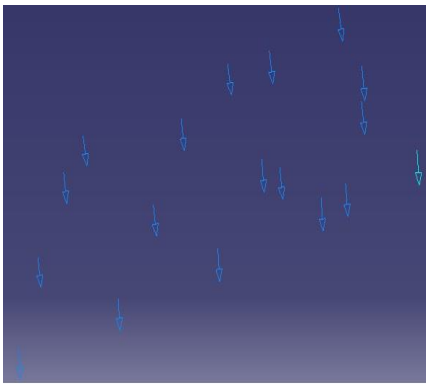

Fig: Zoomed arrows.

The above figure shows the zoomed arrows of translational displacement vector diagram.

CONCLUSION-

To get the results we used the CATIA to evaluate, create and modify the best vehicle design to achieve its set goals. The main goal was to simplify the overall design to make it safe design & more light-weight without sacrificing performance and durability. The result is a lighter, faster, and more agile vehicle that improves design of chassis of solar car.

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