CRASH ANALYSIS OF FRONTAL PART OF CAR BODY USING ANSYS

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Abstract: A significant worry of both the car business and government is the headway of vehicles that would utilize less non-sustainable power source, alongside these crucial focuses; the wellbeing is likewise a significant worry for every single present day vehicle. The idea of Finite Element Analysis of vehicle body has been featured right now. Presently In this task we are going to plan a car vehicle by utilizing configuration demonstrating apparatus Creo Parametric programming, Crash investigation on the vehicle body will be act in Ansys programming by Explicit Dynamic module by utilizing distinctive material. On various velocities of vehicle body, we will examine the, stresses shaped because of crash, twisting and zones of misshapening of vehicle body and strain will be found after investigation. Right now will learn about various material utilized in vehicle body and their properties by which we will be thought about ideal material for the future vehicle. This idea is used for streamlining light weight vehicle which accomplish security highlight with economy.

Index Terms - ansys, creo, vehicle body, material choice, crash.

I. Introduction

Vehicle body light weighting and crash-value are two significant parts of plan. During a car accident, a few sections in the front of car body may have plastic twisting and retain a great deal of vitality. Auxiliary individuals from a vehicles are intended to build this vitality assimilation proficiency and in this way to upgrade the security and dependability of the vehicle. Thus, improvement of security of car is must. The current vehicle creators are logically using lightweight materials to decrease weight; these fuse plastics, composites, aluminum, magnesium and new sorts of excellent steels. Huge quantities of these materials have compelled quality or flexibility, for every circumstance burst is a certifiable likelihood in the midst of the accident event. Material and joining frustration will have certifiable outcomes on vehicle crashworthiness and must be envisioned. In Between a fender bender, a couple of segments in the front of the vehicle body may have plastic twisting. As the dynamic lead of helper people can't equivalent to the static one, the crashworthiness of the vehicle structures must be overviewed by influence examination.

II. Unequivocal DYNAMICS

Unequivocal elements examination is utilized to decide the dynamic reaction of a structure because of stress wave proliferation, sway or quickly evolving time-subordinate burdens. Energy trade between moving bodies and inertial impacts are normally significant parts of the kind of examination being directed. This kind of investigation can likewise be utilized to show mechanical marvels.

III. Motivation behind STUDY

The primary motivation behind an accident investigation is to perceive how the vehicle will carry on in frontal crashes. Vehicle body light weighting and crashworthiness are two significant perspectives which are considered while structuring any vehicle. The suspension outline frames the foundation of the vehicle. Its fundamental capacity is to convey most extreme burden for all planned working condition. This is a piece of planning cycle which can decrease the requirement for expensive ruinous testing program. This technique has an incredible breadth in all car industry as it lessens the expense of genuine accident testing of the vehicle. Because of cooperation of different organizations the clients have an assortment of vehicles to pick. Henceforth, all the organizations are receiving this strategy for reproduction to limit the weight.

IV. Problem Statement

The vehicle business is attempting to improve three topics which are vitality protection, security and solace. Further, because of the humongous increment of vehicles out and about, many research colleges are concentrating on improving the vehicle security gauges. Given the present volume of vehicles out and about, a great deal wellbeing measures are being created so as to protect the travelers, which thus intend to make the vehicles to ingest more vitality during vehicle impact. In the present examination, plan improvement of full-frontal structure of a vehicle to expand the vitality assimilation is led.

1.1 Objective

- Time improvement can be accomplished

- Selection of material based on quality.

1.2 Data and Sources of Data

For this investigation auxiliary information has been gathered from the different research papers. All the literature that we have studied so far is applied different methodology. In some of the papers the car body is designed by different software and analysis is done for more than two materials. In all the materials they collide the car body with concrete wall. Such researches also take side impact into consideration, while some researches also take engine and chassis parts in crashworthiness. All the literature collects data from software and compare to one other materials and provide the conclusion for their work.

1.3 Crash Simulation: A Virtual Concept

An accident reenactment is a virtual amusement of a damaging accident trial of a vehicle or a roadway monitor rail framework utilizing a PC recreation so as to look at the degree of security of the vehicle and its tenants. Crash reproductions are utilized via automakers during PC helped building (CAE) investigation for crashworthiness in the PC supported structure (CAD) procedure of displaying new vehicles. During an accident reproduction, the motor vitality, or vitality of movement, that a vehicle has before the effect is changed into misshapening vitality, for the most part by plastic twisting (versatility) of the vehicle body material (Body in White), toward the finish of the effect. Information acquired from an accident reproduction show the ability of the vehicle body or gatekeeper rail structure to secure the vehicle tenants during an impact (and furthermore people on foot hit by a vehicle) against injury. Significant outcomes are the distortions (for instance, guiding wheel interruptions) of the tenant space (driver, travelers) and the decelerations (for instance, head speeding up) felt by them, which must fall beneath limit esteems fixed in lawful vehicle security guidelines.

I. RESEARCH METHODOLOGY

Most importantly we make a 3d model in creo programming. Two perspectives on model are demonstrated as follows. Here we use creo parametric programming for demonstrating vehicle body.

2.1 Model Development

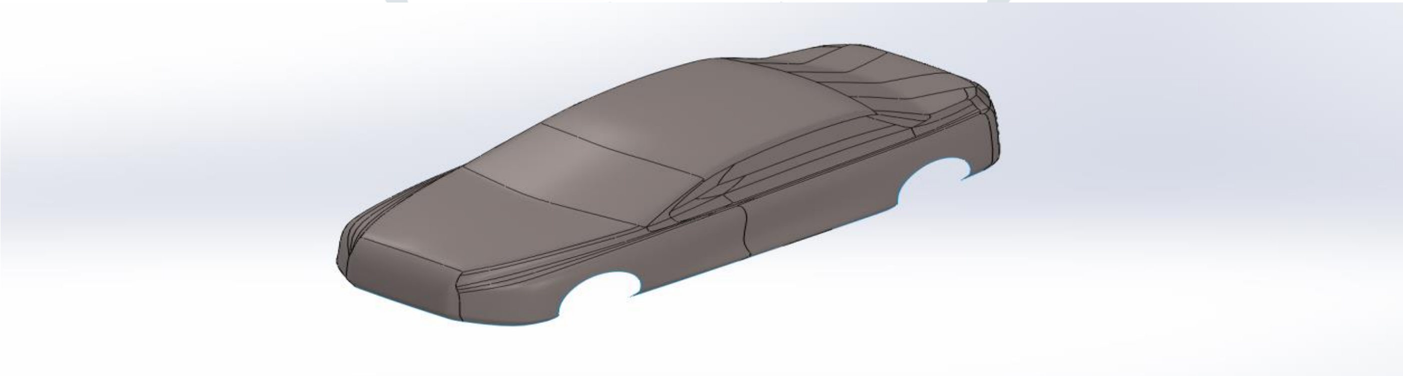

Fig 1:3d Model (front view)

2.2 About Ansys Software

ANSYS 14.5 conveys creative, emotional reproduction innovation propels in each significant Physics discipline, alongside upgrades in figuring velocity and improvements to empowering advancements, for example, geometry taking care of, cross section and post-preparing

2.3 About Finite component examination

1) Finite component examination is a numerical procedure to deal with complex geometry, any material properties, any limit condition and any stacking condition.

2) Mathematical model of any geometric model depicts the conduct of geometry by differential condition and limit condition.

3) Mathematical model is separating the object of enthusiasm into limited number of components.

4) The term level of opportunity is regularly utilized for physical article.

5) If the quantity of level of opportunity is limited, the model is called discrete and nonstop.

2.4 Aluminum Alloy AT 100 km/hr

Here, first we take aluminum alloy material for car body and we take concrete material for wall. The velocity of the car will be taken as 100km/hr.After analysis we get total deformation results which are shown below.

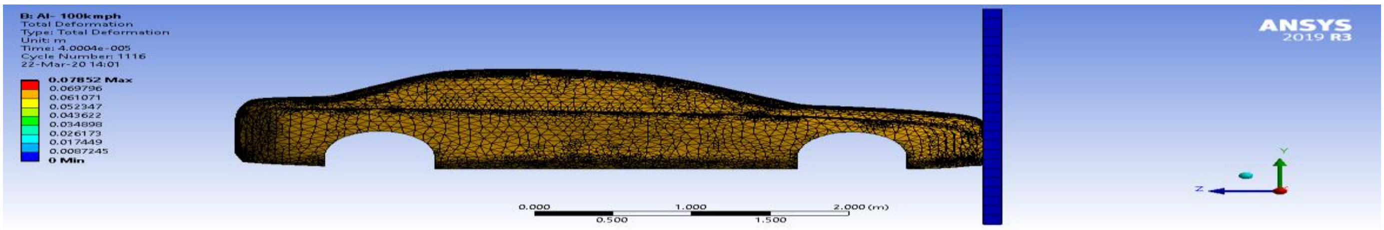

Fig 4:Total deformation of aluminium alloy(100km/hr)

2.5 Aluminum Alloy AT 150 km/hr

Now the velocity of the car will be taken as 150km/hr.After analysis we get total deformation results which are shown below.

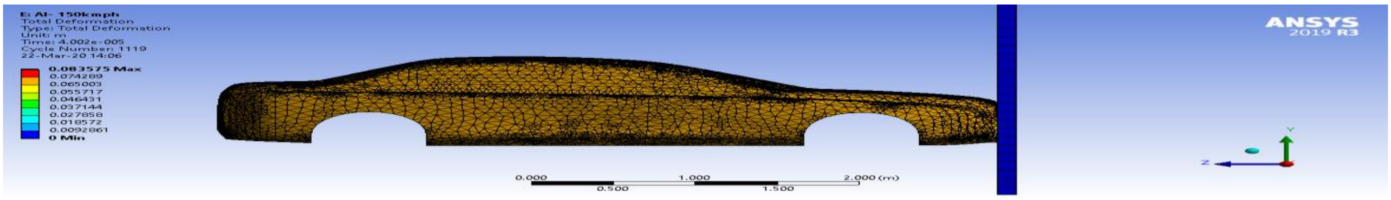

Fig 5:Total deformation of aluminium alloy(150km/hr)

2.6 High Strength Carbon Fiber AT 100 km/hr

Here, first we take HSCF material for car body and we take concrete material for wall. The velocity of the car will be taken as 100km/hr.After analysis we get total deformation results which are shown below.

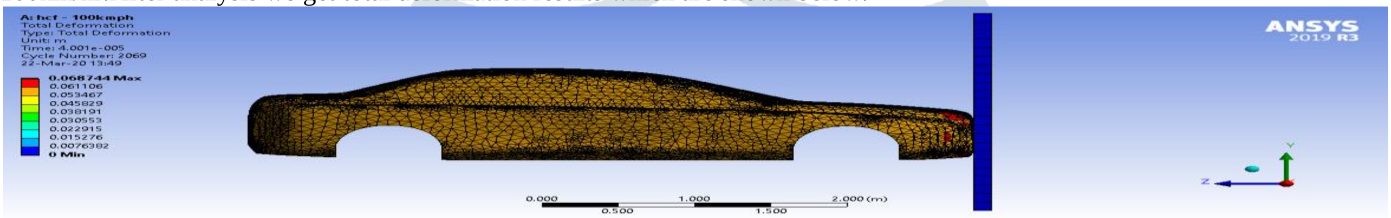

Fig 6:Total deformation of HSCF(100km/hr)

2.7 High Strength Carbon Fiber AT 150 km/hr

Now the velocity of the car will be taken as 150km/hr.After analysis we get equivalent stress, equivalent strain and total deformation results which are shown below.

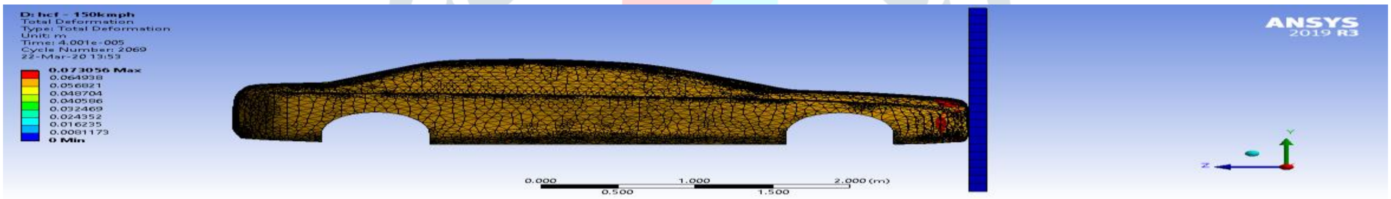

Fig 7:Total deformation of HSCF(150km/hr)

2.8 Simulation of car body to another car body at 100 km/hr

Now we have done the simulation of car body against another car body. The Process will be same as above. After analysis we get following results for aluminum alloy at 100 km/hr.

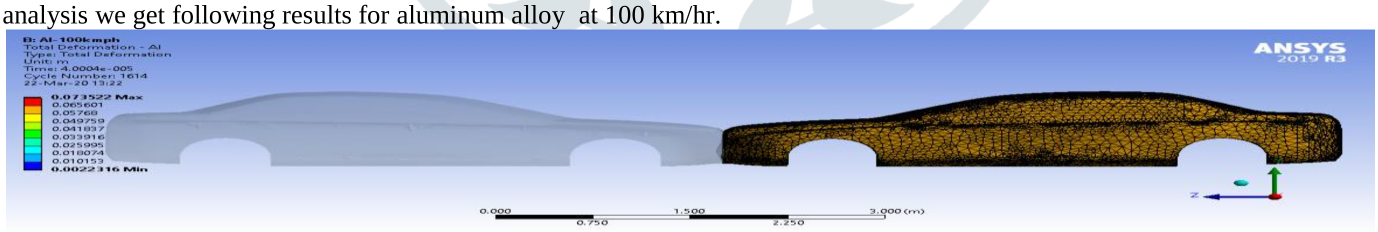

Fig 8:Total deformation of aluminium alloy(100km/hr)

2.9 Simulation of car body to another car body at 150 km/hr

Here, first we take aluminum alloy material for car body and we take concrete material for wall. The velocity of the car will be taken as 150km/hr.After analysis we get equivalent stress, equivalent strain and total deformation results which are shown below.

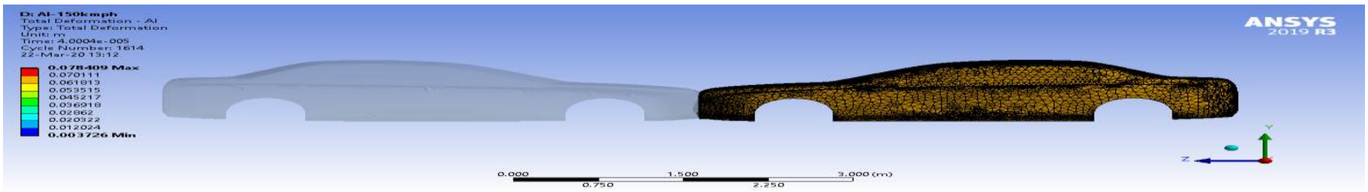

Fig 9:Total deformation of aluminium alloy(150km/hr)

2.10 High Strength Carbon Fiber AT 100 km/hr

Here, first we take HSCF material for car body and we take concrete material for wall. The velocity of the car will be taken as 100km/hr.After analysis we get equivalent stress, equivalent strain and total deformation results which are shown below.

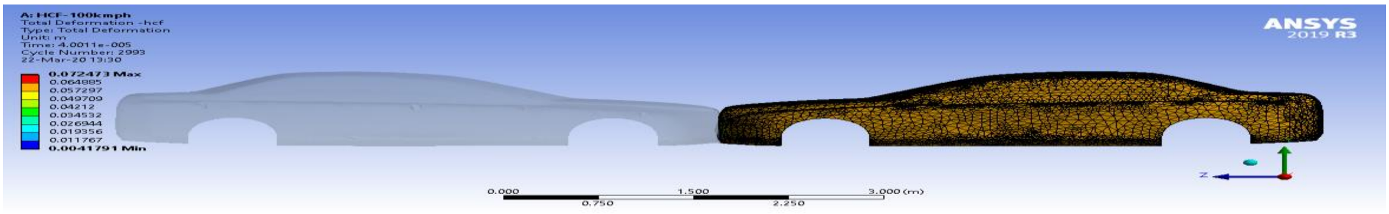

Fig 10: Total deformation of HSCF (100km/hr)

2.11 High Strength Carbon Fiber AT 150 km/hr

Now the velocity of the car will be taken as 150km/hr.After analysis we get equivalent stress, equivalent strain and total deformation results which are shown below.

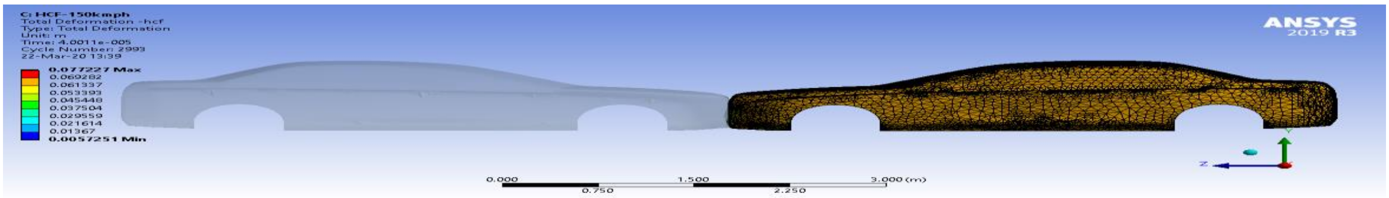

Fig 11: Total deformation of HSCF (150km/hr)

2.12 Simulation of car body to road divider.

Now we have done the simulation of car body against road divider. The Process will be same as above. After analysis we get following results for aluminum alloy for 100 km/hr.

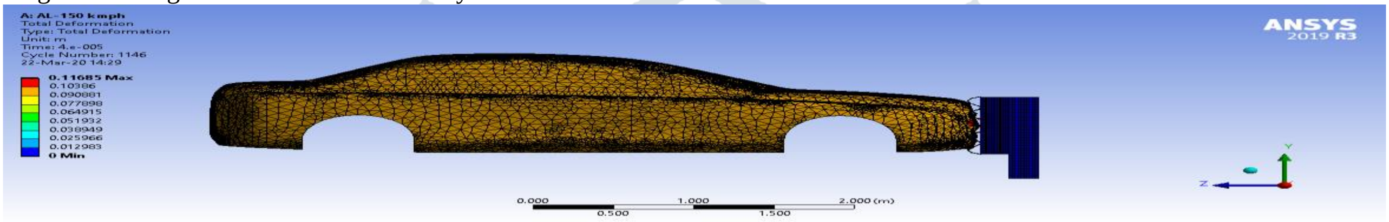

Fig 12: Total deformation of aluminum alloy(100km/hr)

Now the velocity of the car will be taken as 150km/hr.After analysis we get equivalent stress, equivalent strain and total deformation results which are shown below

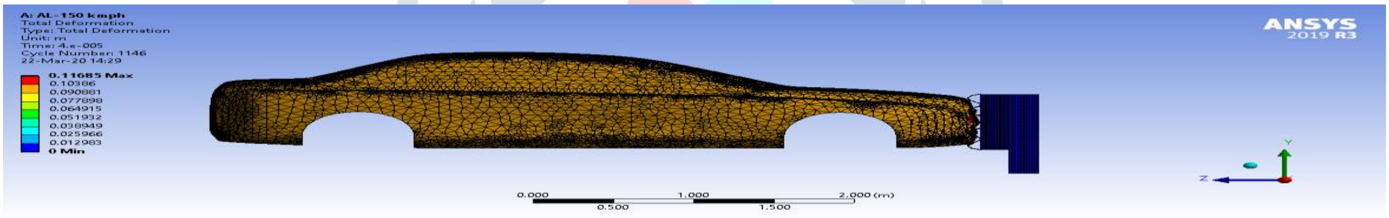

Fig 13:Total deformation of aluminium alloy(150km/hr)

2.13 High Strength Carbon Fiber AT 100 km/hr

Here, first we take HSCF material for car body and we take concrete material for wall. The velocity of the car will be taken as 100km/hr.After analysis we get equivalent stress, equivalent strain and total deformation results which are shown below.

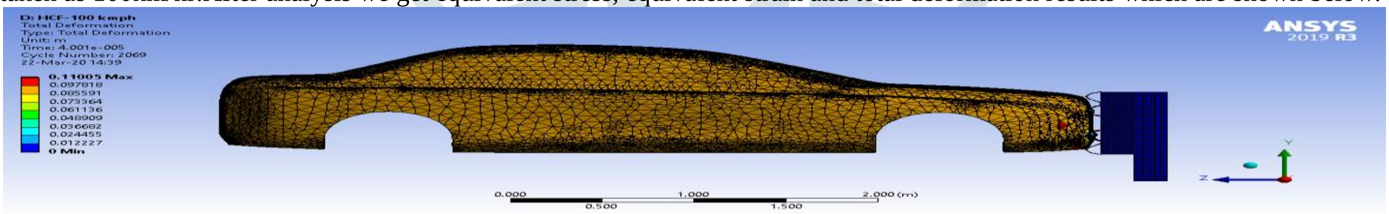

Fig 14: Total deformation of HSCF (100km/hr)

2.14 High Strength Carbon Fiber AT 150 km/hr

Now the velocity of the car will be taken as 150km/hr.After analysis we get equivalent stress, equivalent strain and total deformation results which are shown below.

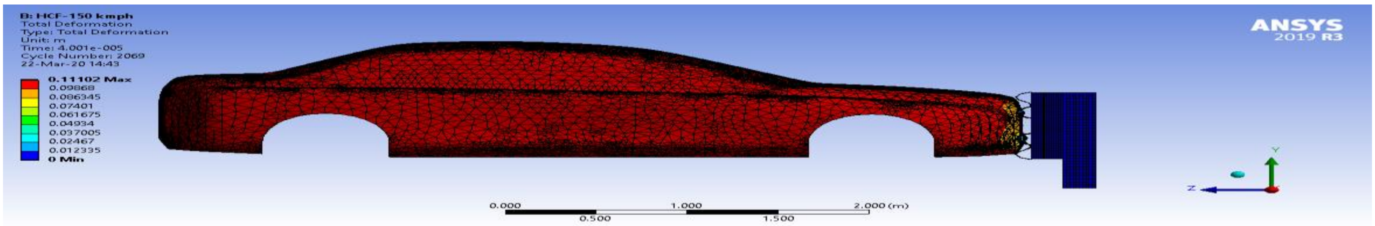

Fig 15: Total deformation of HSCF (150km/hr)

IV. RESULTS AND DISCUSSION

4.1 Results of two different materials

Table 4.1: Deformation of aluminum alloy

DEFORMATION IN ALUMINIUM ALLOY		
CONDITION	SPEED(km/hr)	DEFORMATION (m)
CAR TO CAR	100 (km/hr)	0.073
CAR TO CAR	150 (km/hr)	0.078
CAR TO WALL	100	0.078
CAR TO WALL	150	0.083
CAR TO DIVIDER	100	0.113
CAR TO DIVIDER	150	0.116

Table 4.2: Deformation of HSCF

DEFORMATION IN HIGH STRENGTH CARBON FIBER		
CONDITION	SPEED(km/hr)	DEFORMATION (m)
CAR TO CAR	100	0.072
CAR TO CAR	150	0.077
CAR TO WALL	100	0.068
CAR TO WALL	150	0.073
CAR TO DIVIDER	100	0.11
CAR TO DIVIDER	150	0.111

From table 4.1 and table 4.2, we get results for all three cases, from these results we come to know that at every stage, either we took wall as obstacle, another car body as obstacle or divider as obstacle, the High strength carbon fiber is best material for car body according to other materials, as it can provide max safety and less weight means less fuel consumption too.

In this project Sedan Car body is design with a rectangular concrete wall by using Creo 4.0 software. Part model of car is saved as IGES file and transfer to Ansys Software. Crash analysis is performed by using explicit dynamic module in Ansys. Two different materials such as aluminum alloy and High strength carbon fiber are used as car body materials and concrete is selected as material for wall. Crash analysis is performed on two different speeds 100km/hr., and 150km/hr.Stress, strain, and total deformation are noted as result after explicit dynamic analysis on car body after crash of the car on concrete wall. Results are noted and tabulated according respective speeds and materials. After that we have done explicit dynamic analysis on car body to another car body. Then In third part we did explicit dynamic analysis of car body with divider.

From all the above three cases we got different results for two different materials. At 100km/hr. result table, High strength carbon fiber is showing less deformation value. And also at 150km/hr. High strength carbon fiber is showing least deformation value. As the more crashes will occurs at high speeds hence High strength carbon fiber will provide more safety than other materials, as it has least stress value compare to other materials

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