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Design and Analysis of Exterior Trim In Automotive Design Using Fluid Flow and Explicit Dynamics Techniques

Rahul Pratap Yadav
Research Scholar
IMS Engineering College
Ghaziabad

ABSTRACT
Automotive design is the occupation taking part in the advancement of the appearance, and to some area the ergonomics, of motor automobile or more specific road vehicles. The concept design and evolution of a modern automobile vehicle is consistently done by a huge team from many distinct disciplines combined within automotive engineering. Automotive design in this situation is principally concerned with creating the visual appearance and art theory of the vehicle, though it is elaborate in the formation of the concept product design. Automotive design is exercised by designers who commonly have an art qualification and a degree in transportation design or industrial. For improved concept design result different analysis techniques is utilized such as fluid flow, explicit dynamics, linear buckling techniques. And concept design for exterior trim is the process to transform customer demand in to quality product.

Key Words: Exterior trim, automotive design, explicit dynamics, fluid flow, Structure analysis.

I. INTRODUCTION

The concept design engineer liable for the design of the exterior of the vehicle develops the surfaces, proportions, and shapes of the automotive design. Exterior design is first done by a number of mainframe and free-hand sketches drawings. Constantly, sketches that are more accurate are accomplished and accepted by relevant layers of administration. Clay and or digital models are refined from sketches and drawings. The data from these models are then used to produce a complete image of the final design (body in white). By using three- axis and five-axis CNC milling machines, the clay model is first designed in a computer program and then "engraved" using the machine and large amounts of clay. Even in times of high-class quality 3d software and virtual models on power walls, the clay model is still the most significant tool to calculate and measure the design of a car and therefore used around the industry. In this method free hand sketch is use for basic sketch to design virtual model using UG NX software and then ANSYS will be used for analysis techniques.

Characteristics of good concept design for exterior trim:

1. The generation of concept ideas. At this stage designer makes numeral sketches.
2. The flexible combining of alternative ideas.
3. The creation of tremendous fine sketches.

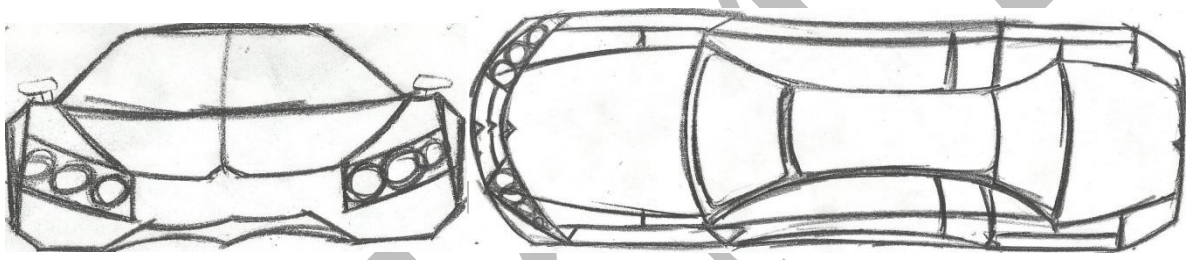
For exterior design designer have different idea to generate a perfect sketch. And framework provides the designers and engineers maximum possible scope for perfect concept.

II. DESIGN PROCESS

1. **Concept design sketch/Exterior trim sketches,** at this stage designer make various freehand sketches. And sets of boundaries apply to make sketch perfect. It's also called as product development stage. Pencils,

scales, drawing papers and markers etc. use as working tools. Based on different condition and attributes designer produce proportional model. After basic sketch designer produce tap-drawing on a package plan on 1:1 scale including all technical and constructional consideration. Design is developed in detail with complete dimensions and specifications. Tools used to draw these sketches - 100-8B, 100-EE, 8911/8B pencils and 27.5cm x 34.7cm size Paper.

a.Front View **b.Side View**



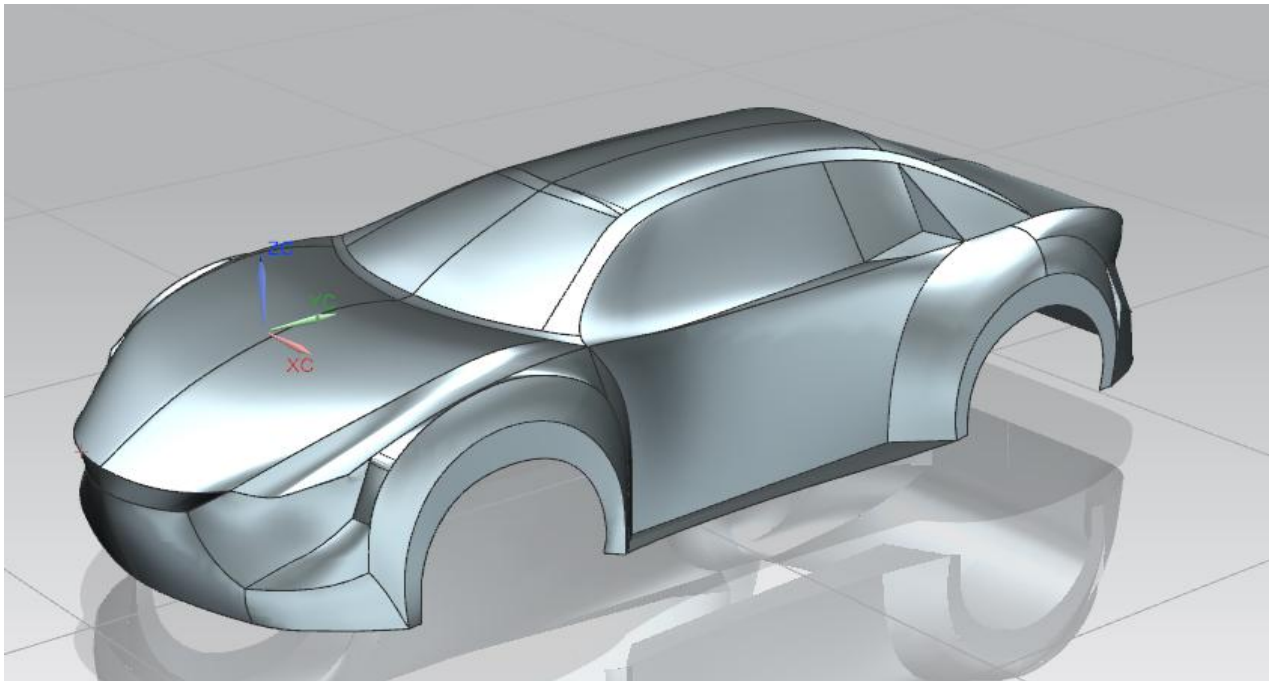
c.Back View **d.Top View**

2D model plan of product

2. **Clay model for exterior trim,** Industrial plasticine, or "clay", which is used for this purpose, is a malleable material that can be easily shaped, thus enabling designers to create models to visualize a product. Clay modeling was soon accepted throughout the industry and remains in use today.

3. **Design of exterior trim**, using Computer-aided design, Once the design has been selected by the customer, it's time for more precise and actual dimension CAD is the use of computer systems to support in the formation, correction, analysis, or development of a design. CAD software is used to increase the productivity of the designer, increase the quality of sketches, design, and transmission through documentation. Computer-aided design is used in many product and industrial design area. Its use in developing and designing of electronic systems is known as electronic design automation.Mechanical design Known as mechanical design automation, which includes the process of creating a technical drawing with the use of computer software.

Specification of design:
Length:2000mm,
Width:4450mm,
Height: 1150mm.

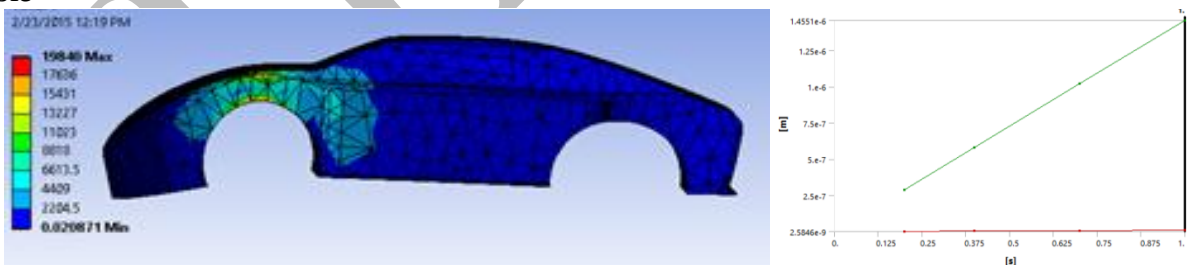


Virtual 3D Model Using Software UG NX

This is also known as digital design which provides 3-Dimensional shape for that a large amount of data has to be collected.

III. ANALYSIS

1. Structure Analysis: Structural analysis is principallyrelated with determining the nature and performance of a physical structure when subjected to certain force or velocity. Structural dynamics, therefore, is a category of structural analysis which covers the performance of design subjected to dynamic (actions having high acceleration) loading. It is natural to use the finite element method (FEM) to this analysis because, like other calculations using the FEM, the object being evaluated can have arbitrary shape and the results of the calculations are acceptable

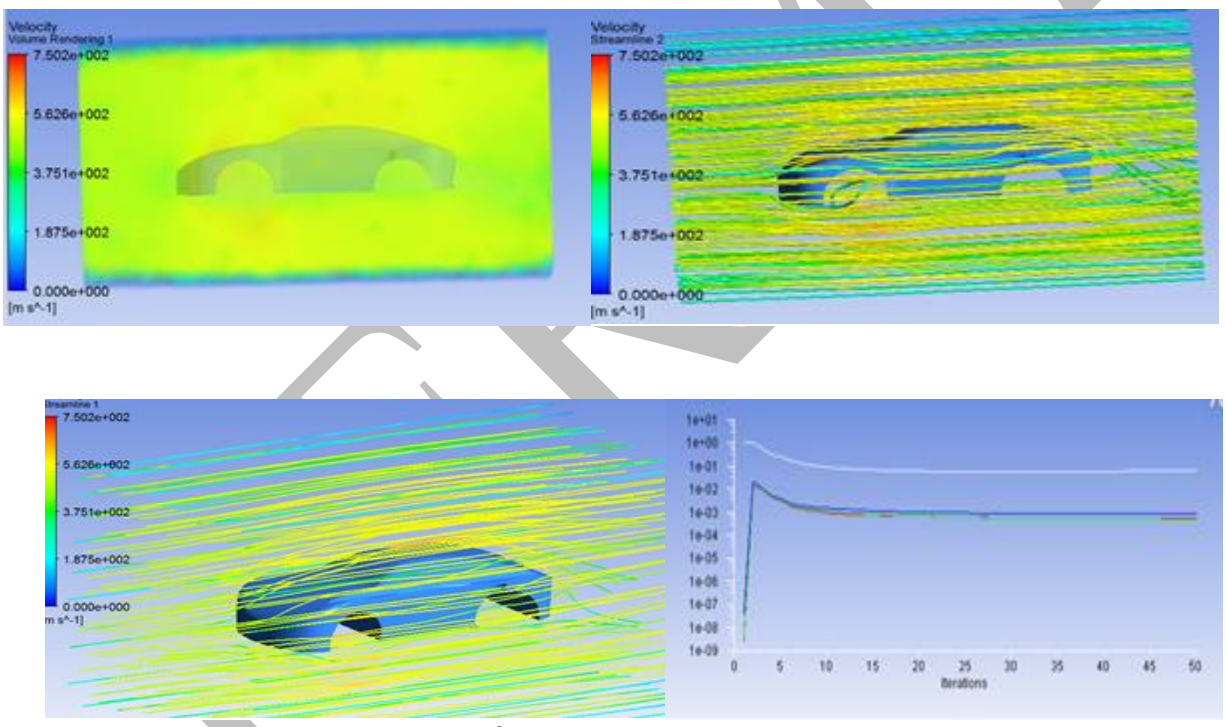


a. Static structure equivalent stress solution.,

b. total deformation solution

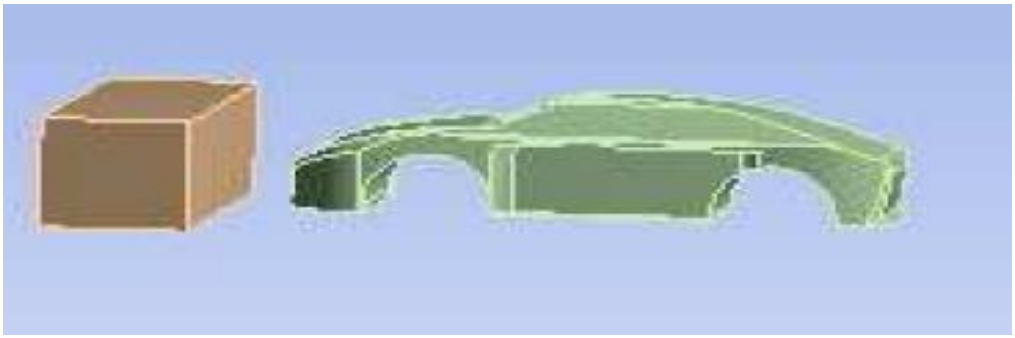
Total deformation and equivalent stress method is used here. Material aluminum alloy NL is used, having density 2770 kg m^-3, specific heat is 875 J kg^-1 C^-1, poisson's ratio is 0.33. In Z direction -1500N force is applied.

2.Computational fluid dynamics: Usually abbreviated or compress as CFD, is a division of fluid mechanics that uses numerical approach and algorithms to solve and analyze problems that involve fluid flows. Computers through CAD software are used to execute the computation required to simulate the interaction of liquids and gases with surfaces defined by boundary conditions. With high-speed supercomputers, better solutions can be accomplished. For this analysis serial processing option is used with double precision. Pressure based absolute velocity formulation is adopted with steady time. ANSYS software improves the accuracy and speed of complex simulation scenarios such as transonic or turbulent flows. Initial experimental validation of such software is performed using a wind tunnel with the final validation coming in full-scale testing.

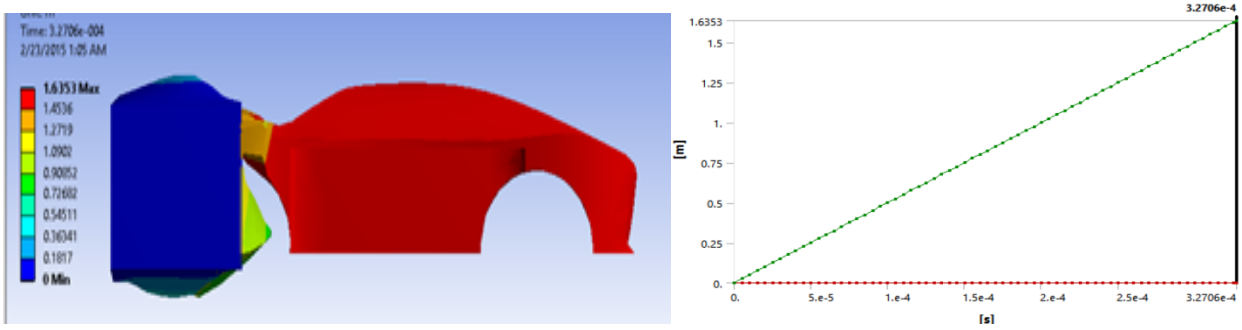


a. Stream line flow and iteration calculation

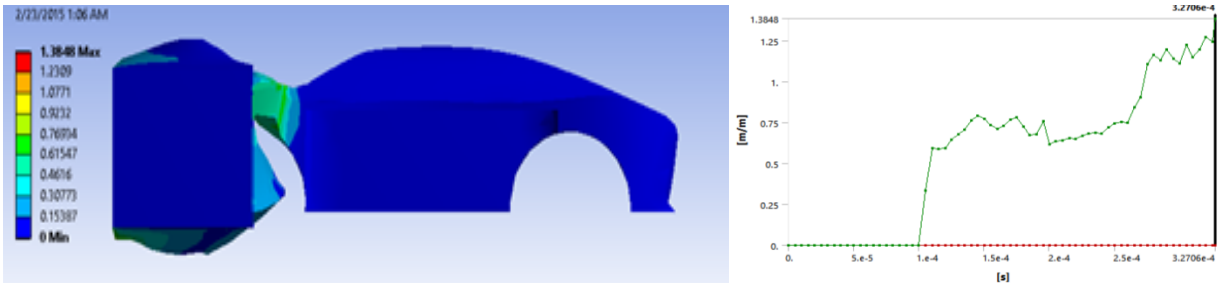
3.Explicit Dynamic methods are techniques used in numerical analysis for retrieve numerical solutions ofpartial differential equations and time-dependent ordinary , as is required in computer simulations of physical methods. Explicit methods calculate the state of a structure at a later time from the state of the system at the current time, while implicit methods find a solution by solving an equation involving both the current state of the system and the later one. Mathematically, if $Y(t)$ is the current system state and $Y(t+\Delta t)$ is the state at the later time (Δt is a small time step), then, for an explicit method $Y(t+\Delta t) = F(Y(t))$



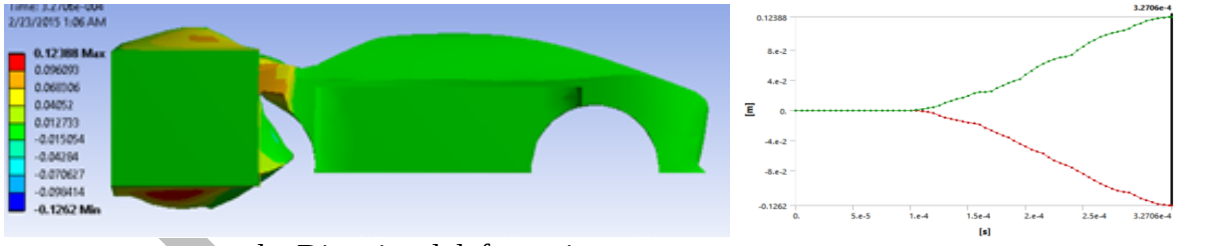
a. Explicit Dynamic Analysis Setup



b. Total deformation solution

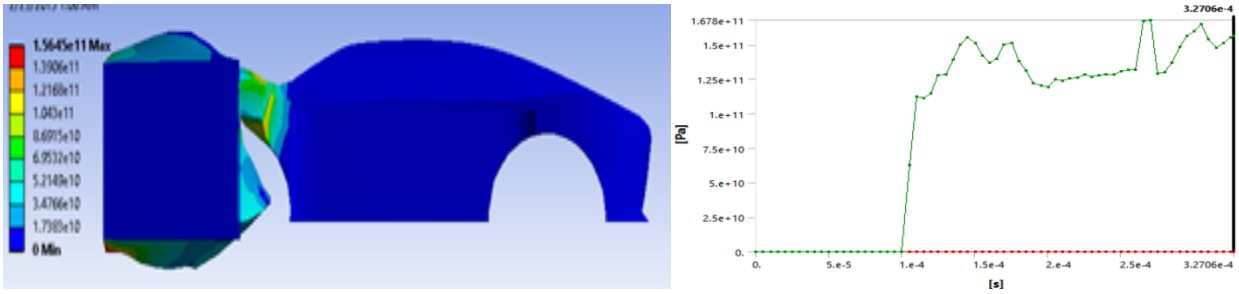


c. Equivalent elastic strain solution



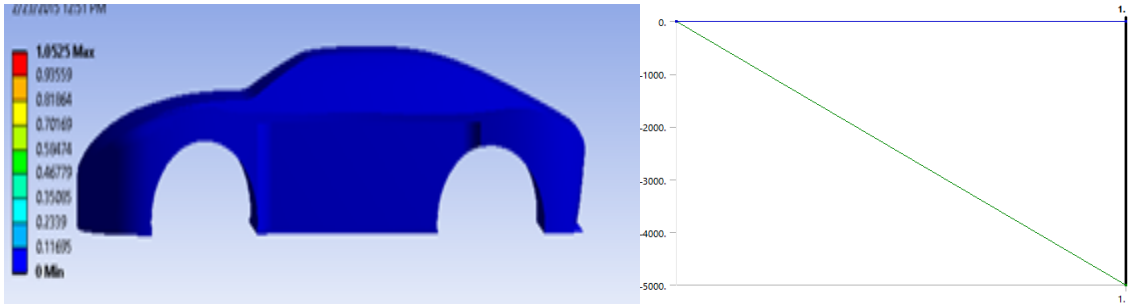
d. Directional deformation

e. Total velocity



f. Equivalent stress

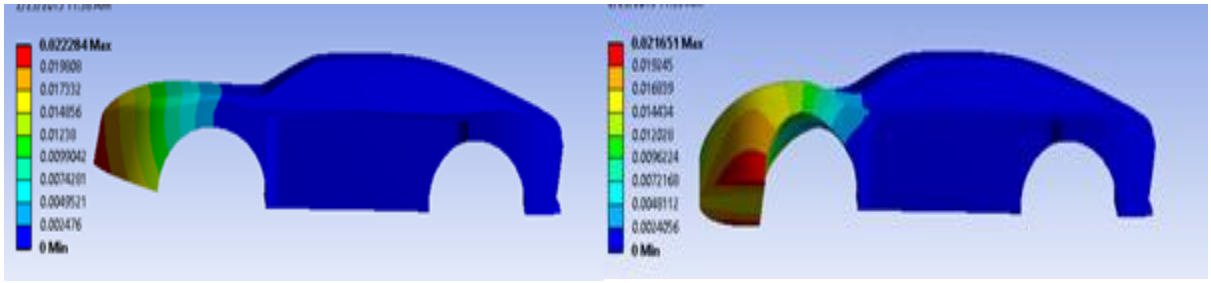
4. Linear Buckling, in science buckling is aanalytical instability, leading to a failure mode. Theoretically, buckling is caused by a bifurcation in the solution to the equations of static equilibrium.



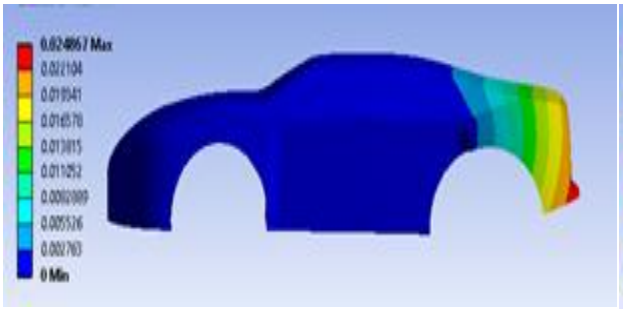
a. Static structure force

b. Static structure total deformation

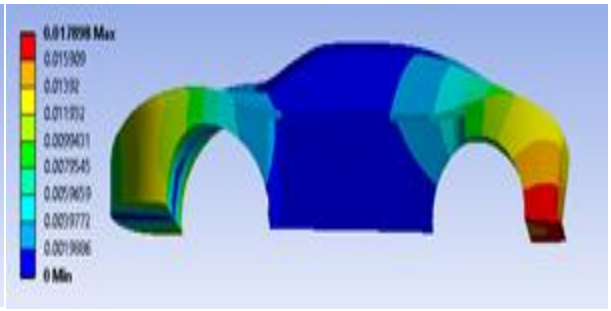
5. Natural Frequency Analysis, Natural frequency is the frequency at which a system leans to oscillate in the absence of any driving or damping force.Free vibrations of any elastic body are called natural vibration and happen at a frequency called natural frequency. Natural vibrations are different from forced vibration which happens at frequency of applied force.



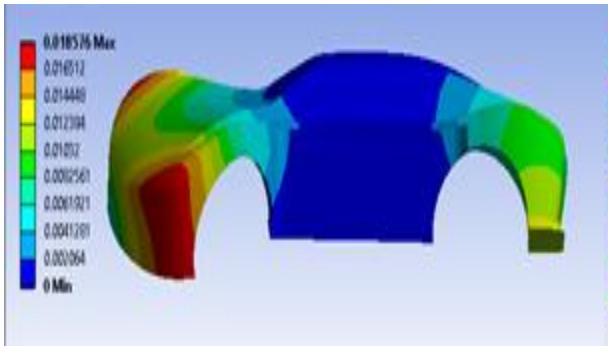
a. Total frequency deformation_1 b. Total frequency deformation_2



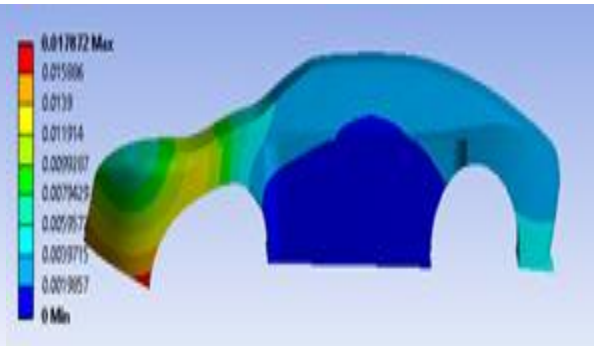
c. Total frequency deformation_3



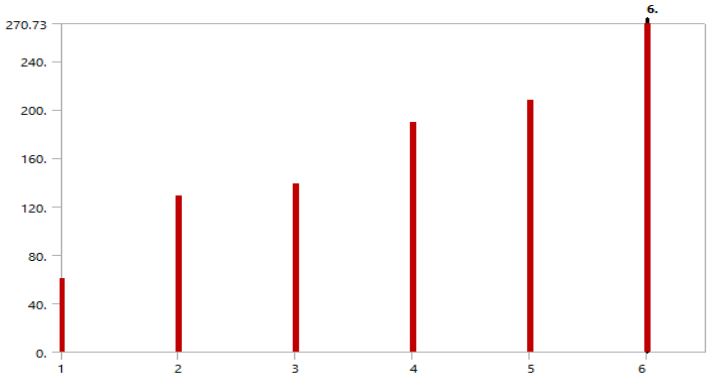
d. Total frequency deformation_4



e. Total frequency deformation_5



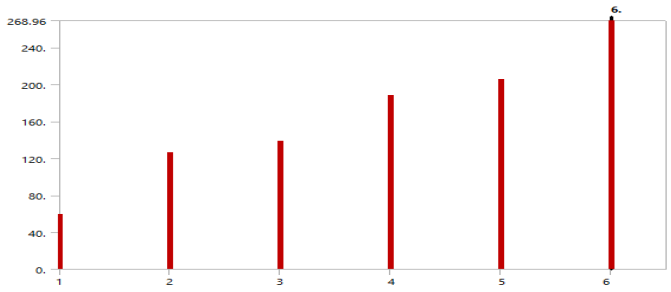
f. Total frequency deformation_6



Mode	Frequency [Hz]
1.	60.673
2.	128.51
3.	138.48
4.	189.66
5.	207.32
6.	270.73

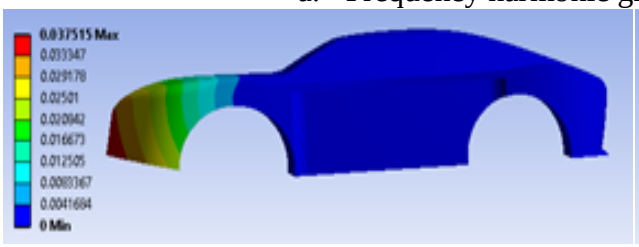
g. Frequency graph plot

6.**Model harmonic analysis**, Harmonic analysis is a branch of mathematics concerned with the representation of functions or signals as the superposition of basic waves, and the study of and generalization of the notions of Fourier series and Fourier transforms (i.e. an extended form of Fourier analysis). In the past two centuries, it has become a vast subject with applications in areas as diverse as signal processing, quantum mechanics, and neuroscience.

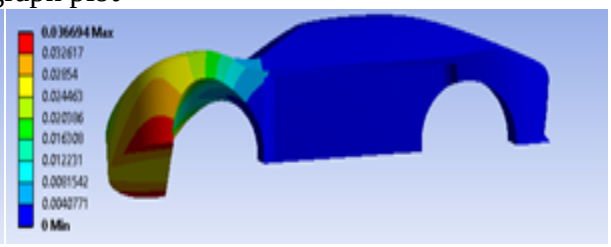


Mode	Frequency [Hz]
1.	59.762
2.	126.6
3.	138.8
4.	187.74
5.	205.36
6.	268.96

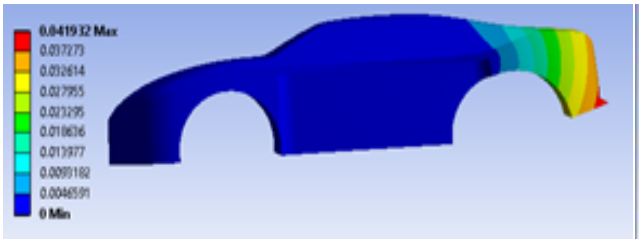
a. Frequency harmonic graph plot



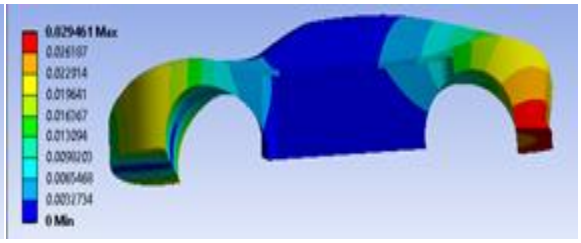
b. Total deformation_1



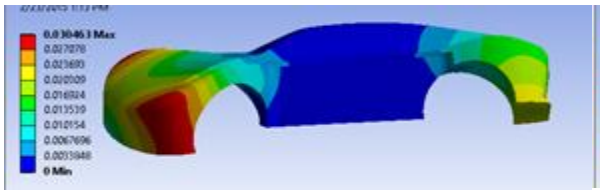
c. Total deformation_2



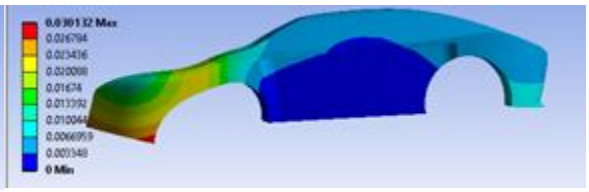
d. Total deformation_3



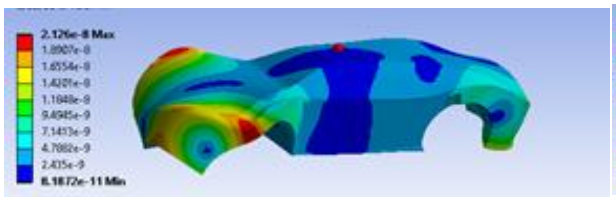
e. Total deformation_4



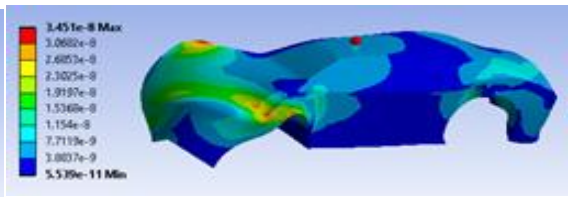
f. Total deformation_5



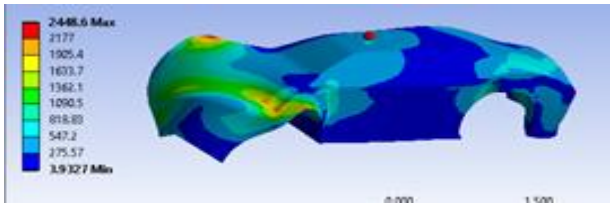
g. Total deformation_6



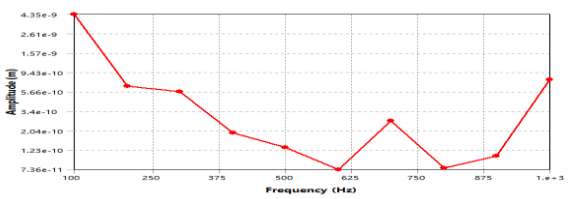
h.Equivalent elastic strain



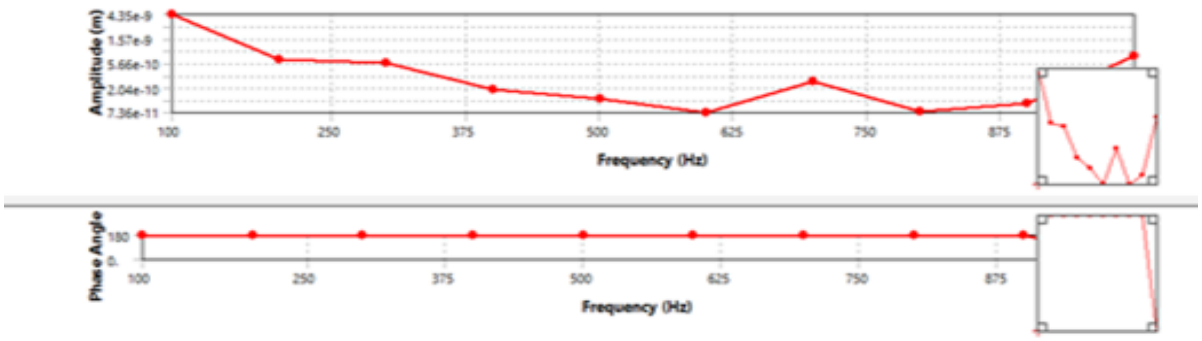
i.Equivalent stress



j. total Frequency response



k.Harmonic Response



Frequency Response

IV CONCLUSION

The blueprint and rendering is converting into 3D Digital surface modeling and rendering for real-time assessment with Math data in introductory phases. During the advancement process succeeding stages will require the 3D model fully defined and developed to meet the creative requirements of a sketch designer and well as all industrial and engineering requirements. UG NX and ANSYS software is used for design and analysis purpose. And with help of result and graph plot, design can modified according to demand.

V FURTHER POSSIBLE WORK

There are many techniques and approaches are here that can formulate the effective design and dimension to know about whether design is fully constraint or not such techniques are as transient and vibration analysis.

VI ACKNOWLEDGEMENT

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VII REFERENCES

1. http://en.wikipedia.org/wiki/Automotive_design
2. http://www.carbodydesign.com/2012/03/the-design-process-at-the-bmw-group/
3. http://en.wikipedia.org/wiki/Clay_modeling
4. http://en.wikipedia.org/wiki/Computer-aided_design
5. http://en.wikipedia.org/wiki/Sketch_%28drawing%29
6. http://en.wikipedia.org/wiki/Structural_dynamics
7. http://en.wikipedia.org/wiki/Modal_analysis_using_FEM
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11. http://en.wikipedia.org/wiki/Natural_frequency
12. http://en.wikipedia.org/wiki/Harmonic_analysis