International Journal of Research (IJR)
e-ISSN: 2348-6848, p- ISSN: 2348-795X Volume 2, Issue 10, October 2015
Available at http://internationaljournalofresearch.org

Design of Car Body Surface & Stiffness Analysis on Surface

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ABSTRACT:

It involves the complete design and production of a scaled model concept car to be released for production in 2014. This undertaking involves less obvious engineering aspects such as creative design, in contrast with complex mathematical models that are ordinarily associated with engineering projects. Our group's goal is to develop a concept two passenger vehicle, which will include a CAD model design, a plastic prototyped exterior, and a painted interior cabin. When designing the conceptual automobile design, the team decided to follow an Educated Creativity model. The model is based on educated design principles where customer needs/wants are identified and ensured to be feasible for implementation. In order to employ this model, the team decided to divide the knowledge base as efficiently as possible, by creating experts in different automobile segments. These segments included propulsion technologies; vehicle dimensions, body styles, aerodynamics design. To aid in the design of the concept, external research on customer buying habits was required. we also believed that it would be extremely beneficial to sit down with a design expert in the automotive industry and learn how they develop their customer needs and vehicle concept ideas. The next step in our design process was to develop a list of competitors that target the same base as our vehicle, thus giving us the chance to benchmark one of these competitors. The car that was benchmarked was the nexis. This was done due to the similarities in size and power train between the sports car and our concept.

INTRODUCTION :

Automotive design is the profession involved in the development of the appearance, and to some extent the ergonomics, of motor vehicles or more specifically road vehicles.This most commonly refers to automobiles but also refers to motorcycles, trucks, buses, coaches, and vans. The functional design and development of a modern motor vehicle is typically done by a large team from many different disciplines included within automotive engineering. Automotive design in this context is primarily concerned with developing the visual appearance or aesthetics of the vehicle, though it is also involved in the creation of the product concept. Automotive design is practiced by designers who usually have an art background and a degree in industrial design or transportation design.

1.1. DESIGN ELEMENTS

The task of the design team is usually split into three main aspects: exterior design, interior design, and color and trim design. Graphic design is also an aspect of automotive design; this is generally shared amongst the design team as the lead designer sees fit. Design focuses not only on the isolated outer shape of automobile parts, but

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concentrates on the combination of form and function, starting from the vehicle package.The aesthetic value will need to correspond to ergonomic functionality and utility features as well.

In particular, vehicular electronic components and parts will give more challenges to automotive designers who are required to update on the latest information and knowledge associated with emerging vehicular gadgetry, particularly dashtop mobile devices, like GPS navigation, satellite radio, HD radio, mobile TV, MP3 players, video playback, and smartphone interfaces. Though not all the new vehicular gadgets are to be designated as factory standard items, some of them may be integral to determining the future course of any specific vehicular models.

1.2.EXTERIOR DESIGN

The stylist responsible for the design of the exterior of the vehicle develops the shape, and surfaces of the vehicle. Exterior design is first done by a series of digital or manual drawings. Progressively, drawings that are more detailed are executed and approved by appropriate layers of management. Clay (industrial plasticine) and or digital models are developed from, and along with the drawings. The data from these models are then used to create a full sized mockupof the final design (body in white). With three and five axisCNC milling machines, the clay model is first designed in a computer program and then "carved" using the machine and large amounts of clay. Even in times of highclass3d software and virtual models on power walls, the clay model is still the most important tool to evaluate the design of a car and therefore used throughout the industry.

1.3 INTERIOR DESIGN: The stylist responsible for the design of the vehicle interior develops the proportions, shape, placement, and surfaces for the instrument panel, seats, door trim panels, headliner, pillar trims, etc. Here the emphasis is on ergonomics and the comfort of the passengers. The procedure here is the same as with exterior design (sketch, digital model and clay model).

1.4. COLOR AND TRIM DESIGN

The color and trim (or color and materials) designer is responsible for the research, design, and development of all interior and exterior colors and materials used on a vehicle. These include paints, plastics, fabric designs, leather, grains, carpet, headliner, wood trim, and so on. Color, contrast, texture, and pattern must be carefullycombined to give the vehicle a unique interior environment experience. Designers work closely with the exterior and interior designers.

Designers draw inspiration from other design disciplines such as: industrial design, fashion, home furnishing, architecture, and sometimes product design. Specific research is done into global trends to design for projects two to three model years in the future. Trend boards are created from this research in order to keep track of design influences as they relate to the automotive industry. The designer then uses this information to develop themes and concepts that are then further refined and tested on the vehicle models.

1.5. GRAPHIC DESIGN

The design team also develops graphics for items such as: badges, decals, dials, switches, kick or tread strips, liveries. Computer aided styling and Class Adevelopment. The sketches and rendering are transformed into 3D Digital surface modeling and rendering for realtime evaluation with Math data in initial stages. During the development process succeeding phases will require the 3D model fully developed to meet the aesthetic requirements of a designer and well as all

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engineering and manufacturing requirements. The fully developed CAS digital model will be redeveloped for manufacturing meeting the ClassA surface standards that involves both technical as well as aesthetics. This data will be further developed by Product Engineering team. These modelers usually have a background in Industrial design or sometimes tooling engineering in case of someClassA modelers. Autodesk Alias and ICEM Surf are the two most widely used software tools for ClassA development.

2.DEVELOPMENT TEAM

The styling team for a specific model consists of a chief designer and an Exterior as well as interior designer. In some cases all three roles are done by one designer. Several junior designer are involved in the development process as well who make specific contributions all overseen by the chief designer. Apart from this the Color and trim designer works closely with other designers. The Clay model team and Digital model team works closely with the styling team all located within the studio. Apart from this there would be studio head, studio managers and prototype engineers who would work across all teams in the studio. The total team size for developing a full sedan usually ranges from 25 to 40 members and the development time lasts for more than 24 months till signed off for tooling and production. Thereafter a smaller team would be working until vehicle launch.

2.1 COMPONENTS:

Integration of an automobile involves fitting together separate parts to form a monocoque body or units and mounting these onto a frame, the chassis.

An automobile chassis basically comprises the following:

1. The body shell, which forms the skeleton of the vehicle.
2. The engine, is the power unit of the vehicle; which in the past has been in large part, the internal combustion engine.
3. Transmission system, which aids in transferring the drive from the engine to the wheels. Its main components are the clutch, gearbox, final drive, and differential.
4. Suspension system, which is used to connect the wheels to the body or chassis frame.
5. Steering
6. Brakes
7. Electrical equipment

The chassis is complete in itself as a road vehicle. It can drive and control itself just as in case of a complete car and therefore, in many motor works, the chassis is usually tested on the road before the complete body of the vehicle is attached as the chassis alone can behave as the propulsion means.

3.EXPERIMENTAL MODAL ANALYSIS:

Experimental modal analysis is the process of determining the modal parameters (frequencies, damping factors, modal vectors and modal scaling) of a linear, time invariant system by way of an experimental approach. In experimental modal analysis, the concerned structure is hung in space using bungee ropes and/or air springs. Then the structure is excited with a force of constant magnitude but varying oscillations and the time and frequency response of the structure is measured using hardware like accelerometers, spectrum analyzers, etc. There are four basic assumptions concerning any structure that are made in order to perform an experimental modal analysis i.e. structure is assumed to be linear, structure is time invariant, structure obeys Maxwell's reciprocity, structure is observable. Figure 1 elaborates the generalized process to carry the modal analysis of BIW of car body experimentally[3]

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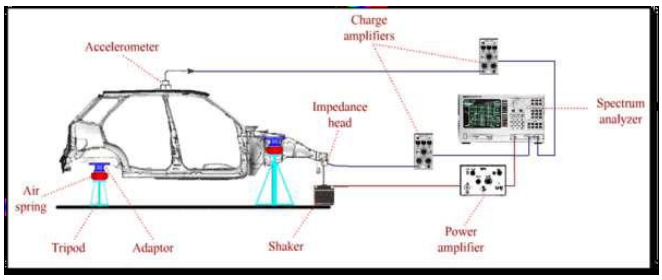

3.1.FEA APPROACH TO MODAL ANALYSIS Finite element analysis is a computer simulation technique for modeling and analyzing the effect of the part or model. Finite element analysis is very useful tool to identify dynamic characteristics such as natural frequencies and mode shapes. The body in white selected in this paper for analysis purpose is shown in Figure 2. The various important parts of sedan type BIW is shown in Figure 3 [4].

RESULTS AND COMPARISON:

FOR CARBON REINFORCED FIBER:

STATIC ANALYSIS:

	Maximum	Minimum
Total deformation	**2.8653e-7**	**0**
Equivalent elastic strain	**7.2572e-7**	**3.7236e-12**
Equivalent stress	**72225.3**	**0.027109**
Strain energy	**2.5902e-9**	**2.2826e-15**

FOR ALLUMINIUM:

STATIC ANALYSIS:

	Maximum	Minimum
Total deformation	**2.3856e-6**	**0**
Equivalent elastic strain	**8.9658e-6**	**7.6036e-9**
Equivalent stress	**716608**	**602669**
Strain energy	**2.71836e-7**	**1.8357e-13**

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CONCLUSION

Our project is to design a new concept model car which has sporty look and aerodynamic feature. The design is done using design software namely Catia v5 which has very good designing tools for design aspect. The final output of car design is completed by adapting latest car concept blueprint, and structural analysis is done on side sheet frame using two materials namely carbon fiber and Aluminum alloy sheet. Among those two materials carbon fiber has good physical features and good dynamic properties carbon fiber has low weight and high strength which helps for better efficiency.

The aerodynamic shape of a vehicle is crucial because it has a large impact on fuel. When buying a new vehicle, carefully consider the impact of aerodynamic features. Remember that time invested in this area will be worth the investment. Installing a sloping front roof on a car could save you as much as 7% of your fuel costs. Even small changes to design and shape will make a difference. This project covers the aerodynamic styling of commercial vehicles. Vehicles that travel at higher speeds and for longer distances will benefit most from aerodynamic styling, giving you greater savings.

After static analysis on both Aluminium alloy sheet and carbon fiber sheet under similar boundary conditions, we have observed that carbon fiber sheet has better stiffness properties when compared to Aluminium alloy sheet. And when compared to strength and weight ratio carbon fiber sheet has better results.

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