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"A REVIEW ON DESIGN AND DEVELOPMENT OF PASSENGER CARS WINDOW SHIELD"

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ABSTRACT

Windshield control is a vital operation of driver during driving. The mountings fitted in the windscreen or also called windshield are essential to use for smooth driving. These can be automated by using sensors and microcontroller. A complete windshield controlling system has been developed here to increase human comfort and flexibility. The wiper has been controlled by a water level sensor which regulate the wiper motor through sensing the level of water or rain.. The mountings fitted in the windscreen or likewise called windshield is fundamental to use for smooth driving. These can be robotized by utilizing sensors and microcontroller. A total windshield controlling framework has been created here to expand human solace and adaptability. The wiper has been constrained by a water level sensor which directs the wiper engine through detecting the degree of water or downpour. A residue sensors has been incorporated to spill some water in the windscreen and afterward wipe it. It detects when a specific degree of residue get gathered in the screen.

Key Words: *Windshield; strength; stress, driver, sensors.*

I. INTRODUCTION

Window may be set on Hinges and can rotate inside and outside of the vehicle serving the purpose of Ventilation. These windows are fixed nowadays on body of the vehicle for better aerodynamic And aero acoustic performance enhancing the exterior look of the vehicle. We will be enclosing the Detail part of design and development of the component in our report. The development is An example of the research and analysis carried out to integrate the Quarterlite fix on to the Vehicle as per the desired specification. The component is developed based on the styling Requirement and functional properties therefore the inputs and outputs to serve the required function plays a significant rule for the design and development of the same. We will be describing the methodology performed during the development, CAD modelling, Simulations and product validation digitally and physically in the testing laboratory. Measurement concept and tolerance study plays a crucial role in the fitment of the part at the vehicle level. We have discussed the necessary requirement with the tolerance management experts and carried out 1D simulation for the same. This also involves coordination with cross functional teams for example Body in white, Door teams as the part is in transition with the door module. The below image Shows an example of Quarterlite fix on the Mercedes Benz GLC. This short information will Give you a glimpse of the component and help in better understanding of the same.

Quarter glass (or quarter light) on automobiles and closed carriages may be a side window in the front door or located on each side of the car just forward of the rear-facing rear window of the vehicle. Only some cars have them. In some cases, the fixed quarter glass may set in the corner or "C-pillar" of the vehicle. Quarter glass is also sometimes called a valence window.

This window may be set on hinges and is then also known as a vent window. Most often found on older vehicles on the front doors, it is a small roughly triangular glass in front of and separate from the main window that rotates inward (see

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top right image) for ventilation.

Many early closed cars, such as the 1940 Pontiac Torpedo had front and rear vent windows called "ventiplanes". It has hinges and a latch, so it can be opened for additional ventilation. Most vehicles since the 1960s have removed this feature for cleaner styling known as "ventless" windows. Some automakers continued to offer vent windows with the American Motors made AMC Pacer having optional front vent windows for increased flow-through ventilation.Although the front venting windows "provide unmatched ventilation, air turbulence and leakage outweigh the benefits". As automobile air conditioning became more popular, front window vents disappeared by the 1980s.

Some vehicles also have glass that rolls down like a regular window or have hinged opening vent quarter windows for rear seat passengers. This may be a side window between the B-pillar and the C-pillar, and in the case of US minivans between the C and D-pillars (examples include the Chrysler Town and Country power-operated venting glass).

They can also be non-movable and mounted in the door itself because that section of the rear side glass would not be able to slide down because of the cut-out in the rear doors required to clear the rear wheel housings. The fixed portion of the glass is separated from the main window that rolls down by a slim opaque vertical bar (see top left image of a close-up of rear door).

A quarter glass can be found set in the body or A-pillar ahead of the front door opening (examples include the Buick Encore, Chevrolet Lumina APV, Toyota Prius, Opel Astra J, Mitsubishi Endeavor, Fiat Grande Punto, Suzuki SX4 sedan, and the 8th-generation Honda Civic sedan).In some automobiles the fixed quarter glass may set in the corner or "C-pillar" of the vehicle. There are also designs that incorporate two quarter windows (see bottom left image) one that is part of the door and the second mounted in the roof pillar. This arrangement may help to increase driver visibility. In this case, the quarter glass in the C-pillar would not be called an "opera window". Non-opening, fixed quarter windows are installed like windshields in that they are bonded to the body with urethane.

Fig. 1.1 Car window

II. LITERATURE REVIEW

Mark Doroudian [2004] Visibility in the automotive industry is a major source of concern for the car manufacturers and safety design engineers. Water film (fog) that forms on the windshield during winter times would reduce and disturb the driver's visibility. This water film is originating from condensing water vapor on the inside surface of the windshield due to low outside temperatures. Primary source of this vapor is the passenger's breath, which condenses on the windshield. Warm and dry air, which impinges at certain velocity and angle relative to the windshield, will reduce the thickness of this water film (defogging) and hence improves driver's visibility. Therefore, a well-designed HVAC system will help reduce this water film thickness to an accepted level for visibility. CFD technology can be utilized to study the defogging process by tracking water vapor content and predict transient variation of condensed water layer on the glass surface. An analytical approach to simulate the defogging process including removal of the water vapor from the passenger cabin glass is discussed. The pre-processing including grid generation was performed using ICEMCFD. The transient thermal CFD simulation was performed using Fluent.[1]

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WANG Qing-songa et.al [2011] In a compartment fire environment, the high temperature encountered could induce important stresses in glass panes, resulting into cracks and possible fallout of the glazing. The aim of the present work is to investigate thermal stress distributions in a glazing system for fire scenarios. A two dimensional glass thermal stress model to calculate the transient temperature and thermal stress distributions in a typical window glass under fire conditions was developed based on the Kong's work. The basic thermal conduction equation and thermal stress equation for glass were discretized by using the Galerkin method. A computer program based on the model was also developed. For validation purposes, simulations have been carried out using literature experimental data on glazing behavior in an enclosure fire. The glass surface temperature (exposed side) and thermal stress distributions in the glass pane were calculated. The simulation results of the transient temperature and thermal stress are overall in line with the experimental data reported in literature. The major principal thermal stress distribution in the glass at the time of first crack is consistent with the experimental crack patterns. The calculated maximum stress is located at the top edge of the glass pane, as the first crack recorded by experiments. The model does not predict second or later cracks. These results illustrate the relatively good predictions and usefulness of the developed simulation code.[2]

Yong Penga [2013] The objective of the present study is to investigate the mechanical behavior of windshield laminated glass in the case of a pedestrian's head impact. Windshield FE models were set up using different combinations for the modeling of glass and PVB, with various connection types and two mesh size (5 mm and 10 mm). Each windshield model was impacted with a standard adult head form impactor in an LS-DYNA simulation environment, and the results were compared with the experimental data reported in the literature. The results indicated that the behavior of the windshield model with a double- layered shell of glass and PVB and a tied element connection support test results from previous studies.Furthermore, the in fluence of glass fracture stress on the same windshield model was investigated, and the cracked area and the peak value of the headform's linear acceleration were determined by the critical fracture stress. It was observed that a 50-MPa fracture stress in the glass best predicted the observed. headform's linear acceleration level and the cracks of the windshield at the time of impact.[3]

Roshan kumar et al [2013]The research paper emphasizes on the design and real time implementation of microcontroller based power window control used as a control system for moving a power window panel. The purpose of power window control system is to raise and lower door glass with the help of a switch and its operation is controlled by the use of following sensors LPG sensor, LDR sensor and position sensor to replace the use of hand-turned crank handle. Power window system consists of driver motor, power electronic and control system. The control unit senses both hard and soft obstructions and deactivates a motor that moves the glass when any obstruction is detected. The controller also senses obstructions on start-up of the motor and regulates the speed of the window panel by pulse width modulating motor signals. In other way the controller senses obstructions by maintaining data which is related to motor operation in three different memory buffers that are regularly updated upon receipt of pulses that are related to motor speed. The whole system can be designed as an intelligent control system by applying number of conditions which results to the movement of the power window. It increases the safety of the automobile as well as increases human comfort inside the vehicle. Such applications are fire safety in the vehicle, over temperature detection, sensing of LPG leakage. Hardware implementation includes some basic input switches, sensors connected to the microcontroller and the LEDs and LCD are used to show the status of output. Input sensors used for this research are LPG sensor, LDR sensor and position sensor, output is the functioning of the motor. The implementation work is carried out using AVR ATMEGA 16 microcontroller [4]

Fazle Elahi, et al [2014] Windshield control is a vital operation of driver during driving. The mountings fitted in the windscreen or also called windshield are essential to use for smooth driving. These can be automated by using sensors and microcontroller. A complete windshield controlling system has been developed here to increase human comfort and flexibility. The wiper has been controlled by a water level sensor which regulate the wiper motor through sensing the level of water or rain. A dust sensors has been integrated to spill some water in the windscreen and then wipe it. It senses when a certain level of dust get accumulated in the screen. The sun visor which is mounted inside the car to shade the driver's eye from sun would be easier to control by a servo motor. Here an automatic sun visor has been designed to be controlled through a light sensor which is used to measure the light intensity and send the signal to the main control unit. This project focuses on improving human comfort in the existing system so that the driver can pay full attention in driving at all weather even in dusty, rainy or summer.[5]

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A. I. PANDEY et al [2015] Power windows or electric windows are automobile windows which can be raised and lowered by depressing a button or switch, as opposed to using a hand-turned handle Power windows provide more safety compare to simple window to avoid accidents particularly for children. Therefore most of automobile industries are shifted towards power window. In design of power window, we have to focus on weight to lift, motor selection and gear design etc.[6]

A.S. Pereverzev et. al . [2016] Research findings and design have allowed to develop a perspective way of the car anti-cracker shield protection, which is the application of the protective pad mounted across the perimeter of the car windscreen and protecting the most vulnerable sections of the windshield from chips and cracks (glass fixing seats in the back of the car). In the course of work the need for development of a way of the car anti-cracker shield protection is justified, the required investigation and the calculation are carried out and the size of the protective pad for a particular car model is determined. [7]

Shunhua Chena [2017] Laminated glass is a simple sandwiched composite structure, while being widely used in the automotive industry as windshield glazings. It is considered to be safety glass due to its excellent performance in absorbing impact energy and bonding glass fragments. Meanwhile, the impact failure patterns of an automotive windshield glazing contribute to the traffic accident reconstruction. In recent decades, a growing interest has been devoted to the impact failure analysis of automotive laminated glass by means of numerical simulations. The purpose of this work is to present a comprehensive review concerning this aspect. We start by introducing six numerical algorithms for the modeling of the principal damage pattern, glass-ply cracking, followed by the introduction of material models for the plastic interlayer, PVB, and then address three numerical techniques for the adhesion modeling. Three kinds of laminated glass models are summarized.[8]

Every year about 400 people die in submersed vehicles in North America and this number increases to 2,000–5,000 in all industrialized nations. The best way to survive is to quickly exit through the windows. An Automatic Window Opening System (AWOS; patent protected) was designed to sense when a vehicle is in water and to open the electric windows, but only when the

Gordon G et.al [2017] vehicle is upright. Methods: The AWOS consists of a Detection Module (DM), in the engine compartment, and a Power Window Control Module (PWCM) inside the driver's door. The DM contains a Water Sensor, a Level Sensor and a Microcontroller Unit (MCU). The Level Sensor provides the angular orientation of the car using a 3-axis acceleration sensor and prevents automatic window opening if the car is outside the orientation range (±20° in the roll axis, ±30° in the pitch axis, with a 2 s delay). Systems were installed on two cars and one SUV. A crane lowered vehicles in water either straight down (static tests) or by swinging the vehicles to produce forward movement (dynamic tests). Results: In all tests, when the vehicles landed upright, windows opened immediately and effectively. When vehicles landed inverted, or at a very steep angle, the system did not engage until an upright and level position was attained. Conclusions: This system may help decrease drowning deaths in sinking vehicles. If occupants do not know, or forget, what to do, the open window could hopefully prompt them to exit safely through that window.[9]

Stanislav Špirk et al [2021] The rail industry has been significantly affected by the passive safety technology in the last few years. The tram front-end design must fulfill the new requirements for pedestrian passive safety performance in the near future. The requirements are connected with a newly prepared technical guide "Tramway front end design" prepared by Technical Agency for ropeways and Guided Transport Systems. This paper describes research connected with new tram front-end design safe for pedestrians. The brief description of collision scenario and used human-body model "Virthuman" is provided. The numerical simulations (from field of passive safety) are supported by experiments. The interesting part is the numerical model of the tram windshield experimentally validated here. The results of simulations are discussed at the end of paper. [10]

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III. Conclusion

This thesis is the real time work of design and development of Quarterlies fix for the passenger vehicle carried on one of the upcoming Mahindra vehicle. This report explains and covers the complete design cycle from concept to the launch of the product. A holistic approach is always needed for the development of the component. This dissertation work focused on the development of the component considering the Design for manufacturing, Design for assembly and Product validation has been given key importance To validate the different aspect of design and fulfill the functional requirement at the vehicle.

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