DESIGN AND ANALYSIS OF CAR BUMPER BEAM COMPARING WITH DIFFERENT COMPOSITE MATERIALS IN ANSYS

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ABSTRACT: In this work, two models of car bumper beams have been designed to analyze the most important parameters including material, thickness and impact conditions are studied for an automotive front bumper beam to improve the crashworthiness design in low-velocity impact. The designs of straight C cross section and curve structured bumper beams using CATIA V5 for modelling and ANSYS WORKBENCH 2021 R1 for analysis of bumper beam under gradual and impact loads. The Total deformation, equivalent stress, equivalent strain is compared for the two designs to obtain optimum design. The bumper beam analysis is accomplished for composite and aluminum material to compare the weight and impact behaviour.

In this work, A front bumper beam made of three materials: aluminum, S-Glass, E-Glass/Epoxy and is studied by impact modelling to determine the deflection, impact force, stress distribution and energy absorption behaviour. The mentioned characteristics are compared to each other to find best choice of material and thickness for selecting suitable material for bumper beam which meets the required characteristics.

Key words: Design, Analysis, Car Bumper, impact modelling, EXPLICIT DYNAMICS, CATIA V5

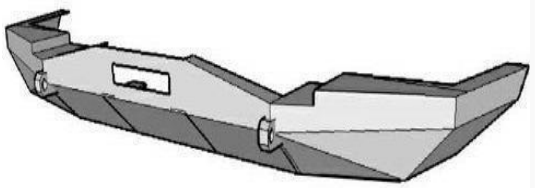
1. INTRODUCTION

1.1 CAR BUMPER

The Bumper Beams are used as shock absorbing parts that are attached to the front and rear ends of cars. The Bumper should support the mechanical components and the body. It must also withstand static and dynamic loads without undue deflection or distortion. The designs of bumpers have gone through lot of improvements Over several years.

Car accidents are witnessed almost every day in which thousands are being injured or even killed. We also witness a lot of damage to the car body parts which in turn causes a lot of economical loss, this may occur in minor accidents as well. This scenario calls for further improvement in safety of automobiles. Bumper beam is one such part of a car which aims at improvement of safety of passengers and car body during accidents.

An automobile's bumper is usually a metal bar or beam, attached to the front-most or rear-most part apparently designed to allow the car to sustain an impact without damage to the vehicle's safety systems. It prevents the impact energy from being transferred to the automobile and passengers. Saving the impact energy in the bumper to be released in the environment reduces the damages of the automobile and the passengers. They are not capable of reducing injury to vehicle occupants in high-speed impacts but are increasingly being designed to mitigate injury to pedestrians struck by cars.



PRIMARY BUMPER DESIGN FOR SAFETY PURPOSE

There are two main strategic parameters being studied during the modelling of bumper beam. First, the material, i.e., how the material used can affect the impact specifications and what kind materials can be used as replacement