EFFECT OF BUMPER THICKNESS WITH COLLISION SIMULATION OF PASSENGER VEHICLES

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ABSTRACT–The finite element method is the most common method used to solve engineering and mathematical model problems. Related solution areas include structural analysis, heat transfer, mass transport and electromagnetic potential. FEM is a specific numerical method used to solve partial differential equations in two or three space variables. To solve a problem, FEM breaks up a large system into smaller, simpler parts called finite elements. First, a three-dimensional model of the system to be analyzed is produced. While defining the model, the materials and connection types found in the model are also deter-mined. Afterwards, the model is divided into small parts and analyzed under specified conditions. A crash test will be conducted in this study. For this, the conditions of the vehicle parts will be examined by hitting a wall under the conditions of which the model design of the vehicle is determined. Crash tests were carried out for two different bumper thicknesses on the same vehicle and the test results were examined. The vehicle speed is modeled as 20 m/s in the simulation carried out from the moment of impact until 0.14 seconds later. The effect of buffer thickness on axial displacements at impact and energy changes are presented.

KEY WORDS : Collision simulation, Finite element analysis (FEA), Vehicle bumper analysis, Vehicle collision model

1. INTRODUCTION

Modeling and finite element analysis (FEA) has been used in many fields such as collision simulation. Traffic accidents occur due to various reasons among automobiles, which are indispensable means of transportation today. These accidents can happen between two vehicles, or between a single vehicle or a vehicle and a pedestrian. Examining the behavior of an electric vehicle in the event of a collision, predicting the contions on the battery is very important to detect possible safety flaws in advance. FEA and collision simulations are also used to examine the possible consequences on vehicle safety for certain collision configurations (Fish and Belytschko, 2007; Liu and Glass, 2013; Pepper and Heinrich, 2017; Reddy, 2004; Thomas, 2017). In addition, although precautions are taken to prevent accidents from occurring, accidents are still inevitable. Especially in the field of vehicle design, many new safety measures have been developed to prevent accidents and reduce the loss of life and property in the event of an accident (Euro, 2020; Li *et al*., 2020; Park, 2014). Many software have been developed to perform collision simulation and analysis to improve the performance and design quality of vehicle design (Forsberg,

2013; Long *et al*., 2019; Shih and Schilling, 2020).

It has been seen that vehicle designs are more reliable, have a higher economic contribution, and errors can be observed beforehand with the finite element method and collision simulation after design. The efficiency of the parts can be examined before the production, which allows to make changes after the simulations. With the developed software, advantages such as making the vehicle parts and the whole vehicle more functional are offered (Thomas, 2017). In this study, as a result of the differentiation of a vehicle part, vehicle collision analysis was performed with the finite element method (Kuznecovs *et al*., 2021; Nikam and Jaiswal, 2021). By performing the crash test of the vehicle model, observing the results and changing the material, differences such as plastic deformation, stress, pressure, time dependent change and displacement were observed and the results were examined.

FEA and then crash test were per-formed in LS-DYNA program. FEA The parameters to be tested in the LS-DYNA program were entered and the necessary tests and analyzes were selected. This analysis and crash test has been examined for a real vehicle. The results can also be obtained separately for the desired parts on the vehicle. In this way, it will be possible to make changes in the necessary places in line with the data obtained. It is possible to make many analyzes about the vehicle in ANSA or

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