Comparative Blast Study of Simulation and Approximation Method of Armored Vehicles

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Abstract. To protect the troopers, it is important to consider the assessment of hazardous areas inside the military vehicle. For armored vehicles, the design, analysis, and test of explosive seat protection are significant to ensure the trooper survivability. Particularly, we note that the significant factor affecting the trooper survivability is ability of trooper seat to absorb shock generated by the explosion.

Therefore, this research focused on the allegorize between blast simulation method and blast approximation method of armored vehicle. A crucial step for armored vehicles design is to analyze the pressure caused by the explosion. However, the blast simulation method does not always provide accurate results. To ensure that the models are reliable, the purpose of this research is to determine and compare the results between the created model and the theory.

Results showed that the simulation models provided the force that affects the vehicle similar to the theoretical-based method. The simulation model designed can be developed and applied to design the various components of the armored vehicle to predict the blast behavior.

Keywords: blast finite element, blast, blast analysis, finite element, blast simulation.

1. Introduction

During the explosion of an Anti Tank (AT) mine or Improvised Explosive Device (IED) under a military vehicle, significant impulse loads generated are transmitted to the occupant through the vehicle-occupant interfaces such as the floor and seat. If these loads are not attenuated to survivable levels, it normally leads to fatality of the occupant. Armor plate of a vehicle is insufficient to protect the occupant against land mine explosions and thus, protective techniques need to be investigated.

Previously, Puasopis and Charoenphon [1] studied the designed trooper-seated attachment. The designed seat attachments were analyzed using the numerical simulation to investigate conditions and variables that impact the trooper survivability. Charoenphon, Veeraklaew and Ridluan [2] studied the explosive effect under the vehicle by optimizing the underneath configuration. The objective is to calculate the optimal angle of the v shape that can reduce the blast pressure wave. However, the influence of blast pressure wave transmitted to the trooper seat is subjected to further analysis.

One concept applied is an Energy Absorbing Seat Mechanism (EASM). For EASM concept, the occupant is protected against the shock pulses by absorbing the kinetic energy of a mine blast through the elastic and/or plastic deformation of various energy absorbing elements thereby attenuating acceleration pulses transmitted from the vehicle structure to the occupant to survivable levels. However, there is currently no effective energy absorbing seat mechanism in use in US Army ground combat vehicles. The alternative way is to design the seat attachment that avoid the high load area.