Survivability Evaluation of Blast Mitigation Seats for Armored Vehicles

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Abstract

Blast mitigation seats are employed in armored vehicles to protect occupants from injuries caused by improvised explosive devices (IEDs). Blast mitigation seats are designed to isolate the seat occupant from high level accelerations caused by the detonation of an IED, which usually corresponds to a high amplitude pulse of 5 to 60 ms duration. Shock attenuation mechanisms employed in seat designs consist of a range of shock isolation technologies, each providing a different response to the shock events. Unfortunately, there currently exist no standard experimental evaluation methods that can be used to fully assess the protection capability of a particular seat design or shock isolation technology. Historically, drop-towers have been used extensively for the purpose of blast mitigation seat testing and comparative evaluation, due to the repeatability of test results using this methodology. Actual field blast tests are also performed to evaluate the survivability of the occupant sitting on the seat in a vehicle. Although more representative of real events, blast tests are more significantly more expensive, involve more logistics, and are not as repeatable as drop-tower tests.

In this paper, the authors developed LS-Dyna CAE models for a typical blast mitigation seat design to study the difference between results obtained from drop-tower tests and those from actual blast events, with the objective of achieving correlations between the two types of tests. The models were then validated with actual test results. Survivability curves were generated for different blast threat levels for both test methodologies through simulations. It was found that the test method selection significantly influences the test results. In particular, it was found that the drop-tower methodology often overestimates the performance of blast mitigation seats, which can result in the fielding of sub-optimal solutions for the protection of occupants.

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