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Modeling and Simulation of Honeycomb Steel Sandwich Panels under Blast Loading

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Abstract : Honeycomb sandwich panels have been widely used as protective structural elements against blast loading. The main advantages of these panels include their light weight due to the presence of voids, as well as their energy absorption capability. Terrorist activities have imposed new challenges to structural engineers to design protective measures for vital structures. Since blast loading is not usually considered in the load combinations during the design process of a structure, researchers around the world have been motivated to study the behavior of potential elements capable of resisting sudden loads imposed by the detonation of explosive materials. One of the best candidates for this objective is the honeycomb sandwich panel. Studying the effects of explosive materials on the panels requires costly and time-consuming experiments. Moreover, these type of experiments need permission from defense organizations which can become a hurdle. As a result, modeling and simulation using an appropriate tool can be considered as a good alternative. In this research work, the finite element package ABAQUS® is used to study the behavior of hexagonal and squared honeycomb steel sandwich panels under the explosive effects of different amounts of trinitrotoluene (TNT). The results of finite element modeling of a specific honeycomb configuration are initially validated by comparing them with the experimental results from literature. Afterwards, several configurations including different geometrical properties of the honeycomb wall are investigated and the results are compared with the original model. Finally, the effectiveness of the core shape and wall thickness are discussed, and conclusions are made.

Keywords : Abaqus, blast loading, finite element modeling, steel honeycomb sandwich panel
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