Mechanical Engineering Thesis Defense

A Framework for Soft Body Armor Design Using Solid Finite Elements

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Abstract

A finite element model that replicates the experimental procedure to test and certify soft body armor has been developed. The model consists of four components: bullet, clay, straps, and shoot pack with different material models that closely capture the behavior of each component when subjected to ballistic impact loading. To test the fidelity of the model, three metrics are used - back face signature (BFS), the number of penetrated shoot pack layers, and the number of damaged shoot pack layers on the clay side of the shoot pack assembly. In addition, the shape and size of the bullet, and the shape and size of the hole in the shoot pack are also considered as qualitative measures to assess the developed model. The focus of this research work is to improve the shoot pack material model, while the constitutive model for the components are taken from earlier work done at ASU. Results show considerable improvement in the model in terms of capturing the number of penetrated layers, the size and shape of the holes in the shoot pack layer, and the predicted BFS. The developed finite element models can be used to predict the behavior of soft body armor for different initial conditions, shoot pack materials, and arrangement of the layers.

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