Artificial Neural Network Application in the Study of Crashworthiness of Thin-Walled Structures with Spherical Triggers

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Abstract:

In case of classic thin-walled energy absorber the energy dissipation is not sufficiently controlled during a collision. A significant part of the columns does not participate in plastic deformation sufficiently. This is due to a lack of proper crush initiators for the formation of subsequent joints. The research problem of the article is to presents a method of applying artificial intelligence methods for determining the optimal parameters of crush initiators, in order to make proper use of plastic deformation zones and improve the efficiency of energy absorption. The methodology is based on the artificial neural network models made possible to select the best and optimal design parameters of multilevel crush initiators. The results of numerical tests were verified on the test bench. The values of all crashworthiness indicators improved, some has been reduced up to 30% from for certain geometric parameters of the multilevel crush initiator. The effectiveness of neural networks is confirmed by the quality of the training, testing, and validation sets at a level of not less than 90% for all analyzed networks. Thus, it is possible to use ANNs to predict crush efficiency indicators for any geometric parameters of the crush initiator.