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Development of a new tool based in neural networks for the design of lightweight ceramic/metal armours against high velocity impact.

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A new tool based on Artifcial Neural Networks (ANNs) has been developed for the design of lightweight ceramic-metal armors against high velocity impact of solids. The developed tool predicts, in real-time, the response of the armor: impact body arrest or target perforation are determined and, in the last case, the residual mass and velocity of the impacting body are obtained. A large set of impact cases has been generated, by numerical simulation, in order to train and test the ANN. The impact cases consider different impacting body and target geometries, materials and impact velocities, all these parameters varying in a wide rangethat covers common impact situations. In order to simulate the behavior of the ceramic material under impact, the constitutive model proposed by Cortes et al. has been modifed and a new algorithm to integrate it has been developed and implemented in a fnite element code. The parameters of the material model have been determined by inverse analysis for different ceramic materials and finally, the modified constitutive model, its integration algorithm and the finite element model have been validated for a large range of impact energies. The ANN developed has shown a remarkable prediction ability of the impact behavior of lightweight ceramic-metal armors and therefore it could be an alternative to the conventional design methodologies.