Blast Mitigation in Composite Shells

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Computational capability for assessing the blast performance of metal/elastomer composite plates and shells is developed. A time discretization of the standard solid model based on the variational update approach of Ortiz and Stainier and the use of the logarithmic and exponential mappings and their first and second linearizations was calibrated via Genetic Algorithms to model the elastomer polyurea. The shell is spatially discretized with subdivision shell elements and the fracture along the element edges is modeled with a cohesive law. Blast performance of the composite shell was developed by assigning the proper model, material properties, and cohesive law to the corresponding metal/polymer (1018 steel/polyurea) across the thickness integration points. The blast resistance has been computed by calculating the kinetic energy of the composite shell subject to underwater blast. The kinetic energy of the composite shell is shown to decrease as the thickness of the polyurea layering increases.

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