Experimental and Numerical Investigation of Impulsively-loaded Composite Plates

M.R. Amini, J.B. Isaacs, and S. Nemat-Nasser

Center of Excellence for Advanced Materials,
Department of Mechanical and Aerospace Engineering
University of California, San Diego, La Jolla, CA, 92093-0416, USA

Abstract

The dynamic response of metal-elastomer bilayer composite plates under impulsive pressure loads is studied, focusing on the underpinning mechanisms of the impact-induced failure phenomena. Direct ballistic experiments are performed. The experimentally observed deformation and failure are simulated using a finite-element code that incorporates physics-based constitutive models for steel and elastomer (polyurea in the present work). The experimental and numerical results show that the relative location of the polyurea layer with respect to the loading direction *i.e*., whether the polyurea is cast on the *front face* or on the *back face* of the steel plate, has a great influence on the energy absorption and the response of the plate. It is found that the polyurea layer can have a significant effect on the response of the steel plate under dynamic impulsive loads, both in terms of failure mitigation and energy absorption, when it is cast on the *back face* of the plate. And, remarkably, when polyurea is placed on the *front face* (*i.e.,* the blast-receiving face) of the plate, our experiments suggest that it may actually enhance the destructive effect of the blast, promoting (rather than mitigating) the failure of the steel plate.

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