Dynamic response of composite plates subjected to blast load

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ABSTRACT

Blasting loads have come to be forefront of attention in recent years due to a number of accidental and intentional events that affected important structures all over the world, clearly indicating that this issue is important for purposes of structural design and reliability analysis. In consequence, extensive research activities in the field of blast loads have taken place in the last few decades, including the research of composites materials for reinforcement of structural elements of armors, vehicles, etc.

The response of fully clamped metal plates subjected to uniform and localized blast loads has been studied for many years by Nurick [1, 2]. Failure of circular plates subjected to uniform blast loads is characterized by a permanent midpoint deflection increased with increasing impulse resulting in thinning at the boundary [3]. Jacinto et al. [4] presented a comparison between testing and numerical responses of metallic plates subjected to explosive loads, in order to obtain guides to the numerical modeling and analysis of this phenomenon. In a previous work [5], dynamic response of composites sandwich plates with carbon nanotubes subjected to blast loading have been studied trough experimental tests in a ballistic pendulum. Small amount of explosive charges were used to impart a uniform and localized blast load.

A numerical simulation of the dynamic response of composite aluminum epoxy resin sandwich plates subjected to blast load in an open environment is presented in this paper. Avoiding the confinement effect of the ballistic pendulum, a greater mass charge of explosive can be used for obtaining midpoint deflection. The sandwich plate is modeled as two faces of aluminum square plates and a 3mm thickness core of epoxy resin. Plastic explosive is used to impart uniform and localized blast loading to the plates. The mass of the explosive is varied to provide a range of response of the sandwich panels from plastic deformation to complete tearing.

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