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Impact analysis of CNT-reinforced composite plates integrated with piezoelectric layers based on Reddy's higher-order shear deformation theory

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Abstract

As a first endeavor in the open literature, the impact analysis of carbon nanotube reinforced composite (CNTRC) plates integrated with piezoelectric layers is studied. In this paper, a novel element-free IMLS-Ritz model with Reddy's higher-order shear deformation theory is employed considering four distributions of carbon nanotubes. The effective material properties of the CNTRC plates are estimated by the Mori-Tanaka method. The modified non-linear Hertz contact law is utilized to define the contact force between the target CNTRC plates integrated with piezoelectric layers and the spherical impactor during the impact duration. Newmark time integration method is employed to identify the dynamic response of the target plates and the impactor displacement. The impactor is assumed to strike the target plate either at CNTRC layer or the piezoelectric one. Novel results for the two cases are presented.

Keywords: Impact analysis; Carbon nanotube; Piezoelectric materials; Reddy's third-order shear deformation theory; Element-free IMLS-Ritz method; Contact mechanics.

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