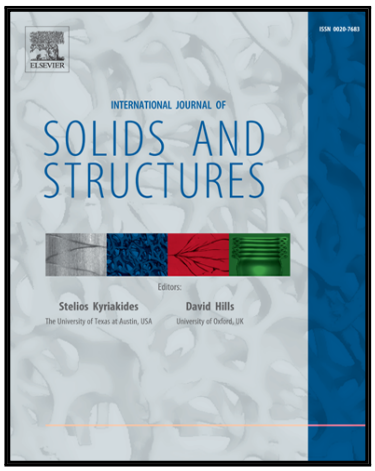

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Experimental and Theoretical Analysis of the Elastic-plastic Normal Repeated Impacts of a Sphere on a Beam

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Abstract:

The normal repeated impact of a sphere upon an elastic-plastic beam has been analyzed experimentally and theoretically. Hertz elastic contact model and seven well known elastic-plastic contact models were selected for theoretical analysis. A piecewise linearized method has been presented to linearize the nonlinear contact stiffness of eight selected contact models. Generalized closed-form solutions (theoretical solutions) of repeated impact response were derived for each piecewise linearization by vibration theory. Ahead of the theoretical study, to gain a deep insight into the eight selected contact models, an idealized repeated impact problem of elastic-plastic half space/foundation was solved by Runge-Kutta integration method. The numerical results show that the models are of large differences in predicting contact behavior, and reveal a strong correlation of the models with the two model parameters: the indentation of initial contact yield and the effective radius of contact curvature of unloading. Experiments were performed with regard to a repeated impact process of a sphere striking repeatedly at the center of the beam. The theoretical and experimental results show that selecting the appropriate contact model is very