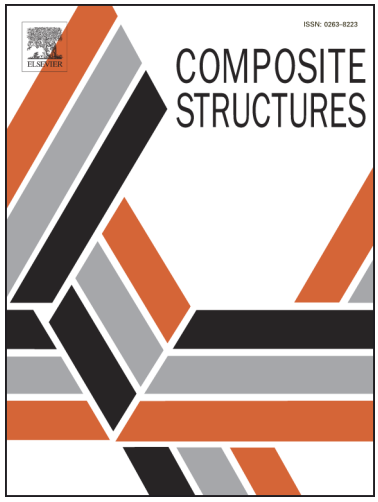

Dynamic response of slender multilayer sandwich beams with metal foam cores subjected to low-velocity impact

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PII: S0263-8223(16)31024-8
DOI: http://dx.doi.org/10.1016/j.compstruct.2016.06.059
Reference: COST 7581

To appear in: *Composite Structures*

Received Date: 20 January 2016
Revised Date: 24 May 2016
Accepted Date: 23 June 2016

Please cite this article as: Zhang, J., Qin, Q., Xiang, C., Wang, T.J., Dynamic response of slender multilayer sandwich beams with metal foam cores subjected to low-velocity impact, *Composite Structures* (2016), doi: http://dx.doi.org/10.1016/j.compstruct.2016.06.059

Dynamic response of slender multilayer sandwich beams with metal foam cores subjected to low-velocity impact

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Abstract. Multilayer sandwich panel is a new potential lightweight structure in practical engineering applications. Dynamic response of fully clamped slender metal foam core multilayer sandwich beams struck by a low-velocity heavy mass is investigated. Based on the yield criteria for the multilayer metal sandwich cross-sections, analytical solutions and 'bounds' of analytical solutions for large deflection of the fully clamped slender sandwich beams are derived, in which interaction of bending and stretching induced by large deflections is considered. Numerical calculations are carried out and good agreement is achieved between the analytical solutions and numerical results. The dynamic solution approaches the quasi-static one when the mass ratio of the striker to the beam is large enough. Using the analytical formulae, optimal design charts are constructed to minimize the mass of multilayer sandwich beams for a given low-velocity impact resistance. It is shown that the dynamic and quasi-static solutions can capture the low-velocity heavy-mass impact response of fully clamped slender multilayer sandwich beams.

Keywords: Multilayer sandwich beam; Metal foam; Low-velocity impact; Overall bending; Optimal design.

1. Introduction

Lightweight structures are being widely used in a number of critical engineering, such as aerospace, aircraft, high speed train, and ship. Sandwich structures with two stiff and strong face sheets separated by a lightweight core are typical lightweight structures, due to their various advantages. Several kinds of cores have been developed, for example, corrugated core [1], honeycomb [2], metal foam [3], pyramidal lattice truss [4], woven material [5], and triangular lattice [6].

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