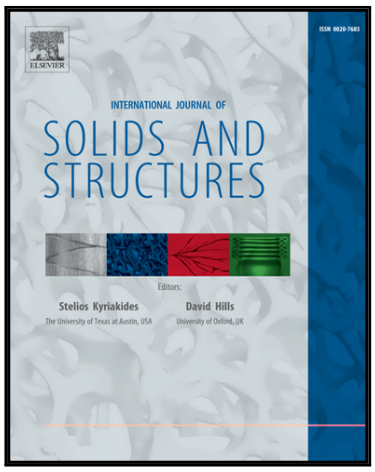

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PII: S0020-7683(17)30528-0
DOI: 10.1016/j.ijsolstr.2017.11.025
Reference: SAS 9814

To appear in: *International Journal of Solids and Structures*

Received date: 19 July 2017
Revised date: 9 November 2017
Accepted date: 27 November 2017

Please cite this article as: Alphose Zingoni , Insights on the Vibration Characteristics of Double-Layer Cable Nets of D_{4h} Symmetry, *International Journal of Solids and Structures* (2017), doi: 10.1016/j.ijsolstr.2017.11.025

Insights on the Vibration Characteristics of Double-Layer Cable Nets of D_{4h} Symmetry

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Abstract

Coupling shallow cable nets into multi-layer configurations offers the possibility of altering the vibration properties of single-layer systems in a beneficial way. When members of appropriate stiffness and damping characteristics are employed as coupling devices, there will be a dynamic interaction between the motions of the layers, with the combined system expected to exhibit a higher stiffness and damping response than the individual layers. Vertical coupling of two identical single-layer cable nets of C_{4v} symmetry results in a double-layer configuration of D_{4h} symmetry, the vertical motions of which are strongly influenced by the symmetry properties of the configuration as well as the stiffness and damping properties of the coupling members. By considering a 32-node double-layer cable net as a case study, the present investigation employs group theory to reveal important insights on the vibration characteristics of cable nets of the type in question, at the same time laying out a computational framework for an efficient vibration analysis of such systems.

Keywords: cable net; vibration; symmetry; group theory; eigenvalue problem; mode shape

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