Accepted Manuscript

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PII: S1359-8368(16)31756-5

DOI: 10.1016/j.compositesb.2016.08.037

Reference: JCOMB 4485

To appear in: *Composites Part B*

Received Date: 7 February 2016

Revised Date: 16 August 2016

Accepted Date: 27 August 2016

Please cite this article as: Zhou XQ, Yu DY, Shao XY, Wang S, Asymptotic homogenization analysis of the dynamics properties of periodically and orthogonally stiffened composite laminates, *Composites Part B* (2016), doi: 10.1016/j.compositesb.2016.08.037.

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ACCEPTED MANUSCRIPT

Asymptotic homogenization analysis of the dynamics properties of periodically and orthogonally stiffened composite laminates

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Abstract: The structural dynamic property of periodically and orthogonally stiffened composite laminar (POSCL) embedded within viscoelastic damping material (VDM) is studied with the asymptotic homogenization analysis method (AHAM) in this paper. A representative unit-cell (RUC) that includes the periodical property of POSCL is extracted from the structure. With the in-plane variables obtained by zigzag laminated theory (ZZLT), the energy equilibrium equation is established based on Hamilton's principle. The equilibrium equations of shear deformation are built by considering the inner shear and initial deformation between the stiffener and the face layers. By introducing the 'rapid' asymptotic factor, the equilibrium equations are expanded by AHAM, and then, the frequency- and temperature-dependent coefficients for all variables are obtained. Finally, the structural loss factor (SLF) of POSCL is determined. In this stage, the factors that affect the POSCL's SLF are thoroughly studied at different temperatures. Validation and comparison are presented at the end of this paper, and the results show that there are advantages to current structures in engineering application.

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