

Accepted Manuscript

Finite-Volume Homogenization of Elastic/Viscoelastic Periodic Materials

Qiang Chen, Guannan Wang, Xuefeng Chen, Jia Geng

PII: S0263-8223(17)32344-9

DOI: <http://dx.doi.org/10.1016/j.compstruct.2017.09.044>

Reference: COST 8907

To appear in: *Composite Structures*

Received Date: 26 July 2017

Revised Date: 7 September 2017

Accepted Date: 17 September 2017



Please cite this article as: Chen, Q., Wang, G., Chen, X., Geng, J., Finite-Volume Homogenization of Elastic/Viscoelastic Periodic Materials, *Composite Structures* (2017), doi: <http://dx.doi.org/10.1016/j.compstruct.2017.09.044>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Finite-Volume Homogenization of Elastic/Viscoelastic Periodic Materials

Qiang Chen ^a, Guannan Wang ^{b,*}, Xuefeng Chen ^a, Jia Geng ^a

^a State Key Laboratory for Manufacturing Systems Engineering, Xi'an Jiaotong University, Xi'an, Shaanxi 710049, PR China

^b Mechanical Engineering Department, Texas Tech University, Lubbock, TX 79409, USA

September 7, 2017

Abstract

In this contribution, the three-dimensional (3D) finite-volume direct averaging micromechanics (FVDAM) is reconstructed by incorporating parametric mapping capability into the theory's analytical framework, which allows using arbitrarily shaped and oriented hexahedral subvolumes in the material microstructure discretization. The technique is then further extended to include linear viscoelastic capability to investigate the creep and relaxation behavior of polymeric matrix composites and stress field evolution with either continuous or discontinuous reinforcements. Elastic-viscoelastic correspondence principle is employed in the unit cell solution to relate the governing relations between time domain and Laplace-Carson domain. After establishing the homogenized constitutive equations and solving the boundary value problems in Laplace-Carson domain, Zakian inversion scheme is used to invert the inexplicit homogenization functions to obtain both relaxation moduli and stress distributions during a relaxation history in real space. The FVDAM theory via correspondence principle is validated extensively by comparing with Mori-Tanaka, finite-element, locally exact solutions and experimental data. Good agreement between the present theory and other methods, along with a few numerical investigations, explains not only the accuracy of the 3D parametric FVDAM but also the validity and efficiency of the correspondence principle and Zakian inversion technique.

Download English Version:

<https://daneshyari.com/en/article/4917746>

Download Persian Version:

<https://daneshyari.com/article/4917746>

[Daneshyari.com](https://daneshyari.com)