

Accepted Manuscript

3D modeling of shape memory alloy fiber reinforced composites by multiscale finite element method

Rui Xu, Céline Bouby, Hamid Zahrouni, Tarak Ben Zineb, Heng Hu, Michel Potier-Ferry

PII: S0263-8223(18)31329-1

DOI: <https://doi.org/10.1016/j.compstruct.2018.05.108>

Reference: COST 9747

To appear in: *Composite Structures*



Please cite this article as: Xu, R., Bouby, C., Zahrouni, H., Zineb, T.B., Hu, H., Potier-Ferry, M., 3D modeling of shape memory alloy fiber reinforced composites by multiscale finite element method, *Composite Structures* (2018), doi: <https://doi.org/10.1016/j.compstruct.2018.05.108>

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.

3D modeling of shape memory alloy fiber reinforced composites by multiscale finite element method

Rui Xu^{a,b}, Céline Bouby^c, Hamid Zahrouni^b, Tarak Ben Zineb^c, Heng Hu^a,
Michel Potier-Ferry^b

^a*School of Civil Engineering, Wuhan University, 8 South Road of East Lake, Wuchang,
430072 Wuhan, PR China*

^b*Université de Lorraine, CNRS, Arts et Métiers ParisTech, LEM3, F-57000 Metz, France*

^c*Université de Lorraine, CNRS, Arts et Métiers ParisTech, LEM3, F-54000 Nancy, France*

Abstract

A 3D generic multiscale finite element method (FE²) is proposed for modeling the pseudo-elasticity and the shape memory effects of shape memory alloy (SMA) fiber reinforced composites. Composites are separated into a macroscopic and a microscopic level, where the constitutive behavior of each integration point on macroscopic level is represented by the effective behavior of a corresponding representative volumic element (RVE). This effective behavior is computed by finite element method under the RVE meshed by volumic element. The real-time information transition between the two levels is realized on a commercial platform ABAQUS via its user defined subroutine (UMAT). A thermodynamic model, proposed by Chemisky et al., [1], is adopted to describe the total constitutive behavior of the SMA. This model considers three path-dependent strain mechanisms related to phase transformation, martensite reorientation and twin accommodation by the derivation of Gibbs free energy. Several thermodynamic tests from the literature subjected to tension-compression and bending loads are studied to validate our multiscale model, which shows good accuracy and reliability. Besides, this model could be used for further design and simulation of SMA applications in a wide range thanks to its generic computing platform ABAQUS.

Keywords: Shape memory alloys; Composites; Numerical homogenization; Multiscale finite element method.

Download English Version:

<https://daneshyari.com/en/article/6703106>

Download Persian Version:

<https://daneshyari.com/article/6703106>

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