

Accepted Manuscript

Estimation of the effective bone-elasticity tensor based on μ CT imaging by a stochastic model. A multi-method validation

D. Gagliardi, V. Sansalone, C. Desceliers, S. Naili

PII: S0997-7538(17)30271-1

DOI: [10.1016/j.euromechsol.2017.10.004](https://doi.org/10.1016/j.euromechsol.2017.10.004)

Reference: EJMSOL 3503

To appear in: *European Journal of Mechanics / A Solids*

Received Date: 3 April 2017

Revised Date: 10 October 2017

Accepted Date: 20 October 2017

Please cite this article as: Gagliardi, D., Sansalone, V., Desceliers, C., Naili, S., Estimation of the effective bone-elasticity tensor based on μ CT imaging by a stochastic model. A multi-method validation, *European Journal of Mechanics / A Solids* (2017), doi: 10.1016/j.euromechsol.2017.10.004.

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.



Estimation of the effective bone-elasticity tensor based on μ CT imaging by a stochastic model. A multi-method validation.

D. Gagliardi^a, V. Sansalone^a, C. Desceliers^b, S. Naili^{a,*}

*Université Paris-Est, Laboratoire Modélisation et Simulation Multi Echelle,
MSME UMR 8208 CNRS*

^a61 avenue du Général de Gaulle, 94010 Créteil Cedex, France.

^b5, boulevard Descartes, 77454 Marne-la-Vallée, France.

Abstract

In previous work, we proposed a stochastic model to describe the elasticity of bone matrix (so-called ultrastructure, US) based on basic statistical information on the *tissue mineral density* (TMD). This information was obtained by analyzing high-resolution images of a human femoral neck realized by means of synchrotron radiation micro-computed tomography (SR – μ CT). In this paper, we extend this study by focusing at the upper scale where cortical bone is described as a two-phase mixture made up of water-filled Haversian pores (HP) embedded in the surrounding solid US. The goal of this paper is to develop a stochastic model of cortical bone elasticity accounting for the effect of uncertainty affecting both phases, the US *via* the TMD and the HP.

Experimental information was assumed to be given in terms of mean values and dispersions of the average TMD (denoted $\overline{\text{TMD}}$) and HP at the millimeter scale. To this aim, SR – μ CT images were used to extract several representative volume elements (RVEs) spanning the whole cortical tissue which, in turn, were analyzed to obtain the required statistical information on $\overline{\text{TMD}}$ and HP. This information has been used for constructing a stochastic multiscale model of cortical bone based on the Maximum Entropy (denoted MaxEnt) principle. This stochastic multiscale model is used in the estimation of the ef-

*Corresponding author

Email address: salah.naili@univ-paris-est.fr (S. Naili)

Download English Version:

<https://daneshyari.com/en/article/7170258>

Download Persian Version:

<https://daneshyari.com/article/7170258>

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