Uncertainty modeling in the prediction of effective mechanical properties using stochastic homogenization method with application to porous trabecular bone

Abstract

A systematic modeling of uncertainty due to image processing, material characteristics and experimental works was developed in order to propose a novel stochastic image-based multi-scale method for heterogeneous media. The effective mechanical properties with application to three porous trabecular bone models were predicted by introducing the correction factor (β) to represent the miscellaneous errors or unknown factors. Finally, the probability density was obtained for the effective mechanical properties, which could evaluate the reliability of scattered experimental results. It has been concluded that variation in effective properties of heterogeneous media can be predicted even when only limited measured values are available by using the present extrapolation technique based on verified simulation results.

Keywords