Scaling and Quasi-static Loading Issues in Nano Finite Element Modeling Using Multi-Scale Virtual Internal Bond using Explicit Finite Elements

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Abstract

The objective of this research is to develop, outline, apply and demonstrate issues involving a new nano explicit finite element based framework, by which the mechanical behavior of mineralized collagen fibrils and their constituents can be studied. A multi-scale virtual internal bond model is used to model the material behavior and failure of such biocomposites. In this research model studies have been performed to study the mechanical behavior of a nano sized dahlite mineral crystal commonly found in collagen fibril. Two important implementation characteristics have been introduced and illustrated, namely that scaled properties can be used at the micro and nano length scales along with scaled dimensions and secondly the loading time can be appropriately scaled without the loading becoming a dynamic loading.

Keywords: Cohesive model, finite elements.