SM13S_12970

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Incremental Effective Constitutive Law for Composite Material in the Form of Artificial Neural Network

Marek Lefik

Chair of Geotechnical Engineering and Engineering Structures, Technical University of Łódź, Łódź, Poland

Description of effective behaviour of composites in the form of a suitably trained Artificial Neural Network is presented in this paper. We assume an incremental form of constitutive relationship approximated by ANN. We propose two methods of acquisition of data for training the ANN. The first one furnishes the pairs: average stress – average strains and their increments – resulting from the solution of boundary value problem defined over a representative volume, with given mean strain imposed. The second method we propose bases on sampling of global behaviour of the composite material. The presented approach is fully numerical. The corresponding algorithm seems to be applicable for a large class of composites. The representation of the constitutive law by ANN can be included as a subroutine into any FE code. Example shows the application of the method for Neo-Hookean material.

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