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A DECOUPLED APPROACH FOR COMPUTING THE RESPONSE OF STRUCTURES MADE OF HETEROGENEOUS, RANDOM ELASTOPLASTIC COMPOSITES WITH HARDENING

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In the present work, we propose a methodology to compute the response of structures made of heterogeneous, random elastoplastic composites. The effective constitutive law is provided by an incremental homogenization method (see e.g. [1]), which allows computing very efficiently the stress-strain relationship at the integration points of the structure without local calculations on the RVE. The accuracy of the method is enhanced by identifying the coefficients of an empirical model related to the matrix, which provides a correction to the initial incremental homogenization scheme solution. For this purpose, the size of the RVE is determined for local microstructures consisting into random distribution of elastic cylinders or pores in a von Mises elastoplastic matrix with nonlinear hardening. Unlike previous approaches (see e.g. [2, 3]), we determine the size of the RVE by performing a statistical convergence analysis not on the response of the microstructure, but on the parameters of the empirical model used for the identification. Numerical results are provided to demonstrate the accuracy and the efficiency of the technique through structure examples.

REFERENCES

[1] I. Doghri and A. Ouaar. Homogenization of two-phase elasto-plastic composite materials and structures: Study of tangent operators, cyclic plasticity and numerical algorithms. *Int. J. Solids Struc.*, 40:1681-1712, 2003.

[2] V.P Nguyen and O. Lloberas-Valls and M. Stroeven and L.J. Sluys. On the existence of representative volumes for softening quasi-brittle materials, A failure zone averaging scheme. *Comput. Meth. Appl. Mech. Eng.*, 199:3028-3038, 2010.

[3] A. Salahouelhadj and H. Haddadi. Estimation of the size of the RVE for isotropic copper polycrystals by using elastic-plastic finite element homogenisation . *Comput. Mater. Sci.*, 48:447-455, 2010.