DISCRETE ELASTIC PARAMETERS FOR LATTICE MODEL WITH EMBEDDED DISCONTINUITIES AND APPLICATION IN CONCRETE FRACTURE

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This work presents a lattice fracture model [1-4] with a choice of parameters that lead to correct elastic continuum response. This choice of elastic parameters is important for post peak softening behaviour of the model, where correct stiffness of the model influence fracture propagation. The procedure for the computation of geometric parameters in a lattice fracture model of this type can match the global stiffness correctly [5] and it is applicable in heterogeneous materials under quasi-static regime. Such model can represent fracture and failure mechanisms in concrete and reinforced concrete structures. We show the procedure for choosing the correct elastic parameters which is based on Voronoi domain discretization of points randomly positioned in the domain. Lattice elements are zero-size elements that can match the global stiffness, but it can also be elastically homogeneous for various Poisson coefficients. Numerical examples show the capabilities of the model for simulation of the pre-peak and post-peak behaviour of fracturing in concrete.

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REFERENCES

[1] M. Nikolić, E. Karavelić, A. Ibrahimbegovic, and P. Miščević, Lattice element models and their peculiarities. *Archives of Computational Methods in Engineering*, Vol. 25, pp. 753-784, 2018.
[2] A. Ibrahimbegovic, Nonlinear solid mechanics: theoretical formulations and finite element solution methods, Springer Science & Business Media 2009.
[3] J. Čarija, M. Nikolić, A. Ibrahimbegovic and Ž. Nikolić, Discrete softening-damage model for fracture process representation with embedded strong discontinuities, *Engineering Fracture Mechanics*, Vol. 236, pp. 107211, 2020.
[4] E Karavelić, M Nikolić, A Ibrahimbegovic and A Kurtović, Concrete meso-scale model with full set of 3D failure modes with random distribution of aggregate and cement phase. Part I: Formulation and numerical implementation, *Computer Methods in Applied Mechanics and Engineering*, Vol. 344, pp. 1051-1072, 2019.
[5] J. Čarija, M. Nikolić and Ž. Nikolić, A Voronoi Based Discrete Numerical Approach for Modelling Reinforcement in Concrete Structures. *International Journal for Engineering Modelling*, Vol. 34 (2), pp. 77-98, 2021.