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Peculiarities of a dynamic lattice-based multi-scale framework for modelling concrete fracture

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Concrete is the most popular building material and yet the one which undergoes the most amount of approximations when it comes to predicting its behaviour. The main reason is the complex micro structure. With this in mind we propose a multiscale framework composed of a macro scale, in which the structure to be analysed is described, and a micro scale with the purpose of describing the formation and evolution of cracks using the lattice model [1]. The micro scale is randomly generated and able to differentiate between the three concrete phases [2]. The two scales are linked by transferring stiffness reduction coefficients (due to cracking) from the micro scale to the macro scale.

In this formulation, a very important factor is the manner in which the boundary conditions are applied at the micro scale. Different approaches are presented and their performance is measured.

Due to use the two scales, two mesh sensitivity analyses are performed, one for each scale. The macro scale, using a more traditional approach, has expected behaviour with different solutions in the literature. The micro scale, with its different approach to modelling the material, exhibits contrasting behaviour to change in element size. The results are presented and interpreted.

REFERENCES

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