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MULTI-AXIAL VALIDATION OF A SIMPLE LATTICE DISCRETE ELEMENTS MODEL FOR HETEROGENEOUS QUASI-BRITTLE MATERIAL

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The purpose of the present submission is to outline the efficiency of lattice discrete elements regarding the modeling of fracture in quasi-brittle materials and more specifically heterogenous ones such as concrete.
The hereby presented model has been subjected to several enhancements:

- First regarding equilibrium's integration, inversely to classic discrete elements models, we propose an implicit integration scheme to improve quantitativeness when cracking and contact mechanisms are involved [1].
- Second regarding the failure criterion of the lattice model. The cohesive part of the lattice model can be pictured as a truss of elastic perfectly-brittle beams. The formulation of the criterion has been adapted, while kept simple (2 or 3 three parameters to be identified), to achieve more accurate energy dissipation for simple uniaxial tests (tension and compression).

Latter uses of such lattice discrete model include the calibration of macroscopic continuous models, as part of a multi-scale procedure. Calibration of macroscopic models would be achieved by inverse identification, in other words fitting, of results obtained with the lattice discrete elements. Since the fitted numerical results will not necessarily be available experimentally in the literature, extensive trust has to be accorded to the lattice discrete model.

As an evaluation of its efficiency, the simulation of several complex tests with the improved lattice discrete model will be presented. These tests will include mode-II fracture of single- and double-notched beams [2] and biaxial fracture enveloppe computation [3]. An original numerical solution for the Willam test will also be computed.

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