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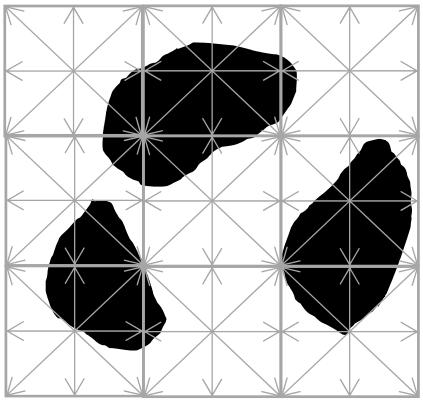
Master Thesis

Discrete lattice-based models for simulating cracking of concrete at meso-scale

Background

- Modelling fracture process within framework of continuum mechanics requires complex numerical treatment.
- Discrete lattice models can introduce cracking process naturally without artificial numerical treatments. There numerical algorithms also offers possibility to have substantial speed up while porting them to HPC architectures such as GPUs. Several lattice Based algorithms have been proposed and some have limitations for modelling all loading regimes.
- **Our goal is to identify lattice based fracture models which can be ported to HPC facilities and can model fracture process under all loading regimes.**

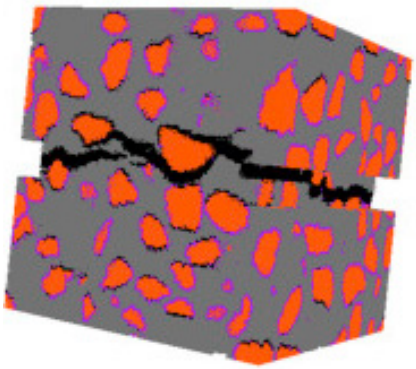


Meso-scale lattice model schematic representation

- We will use mesoscale representation of concrete (explicitly model aggregates and cement matrix) to capture local stress development at interfaces and realistic crack patterns.

Key Tasks

- Comprehensive literature review of lattice model for modelling fracture process and identify potential lattice models for implementations.
- Help with development of generic object oriented framework for lattice based models and implement selected models.
- Perform benchmark calculations by comparing with FEM codes e.g. Abaqus/OOFEM or analytical solutions and present the results.
- Depending on your interest and time available we could further look into porting lattice models to GPU using openACC programming standard.



Example calculations with Delft lattice model (Zhang et al. 2020)

Contact

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