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Multiscale quasicontinuum methods for dissipative lattice models

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Structural lattice models including dissipative mechanisms are frequently used to mechanically model the small-scale discrete structures of fibrous materials (e.g. textiles, paper materials and collagen networks). An important disadvantage of structural lattice models is the associated computational cost that compromises their use at the application-scale. The multiscale quasicontinuum (QC) method can be employed to make application-scale lattice computations feasible and directly incorporates micro-scale mechanisms in regions of interest. Although the QC method has so far been used for atomistic lattices, a number of virtual-power-based QC variants are recently proposed that allow QC methods to be used for structural lattice models with dissipative mechanisms. This is demonstrated for elastoplastic interactions (e.g. useful for textiles) and for interaction-to-interaction bond failure and subsequent frictional sliding (e.g. useful for cardboard). These virtual-power-based QC variants seem to introduce new application fields for the QC method beyond atomistics.

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