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Quasicontinuum-based multiscale approaches for plate-like beam lattices experiencing in-plane and out-of-plane deformation

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Abstract

The quasicontinuum (QC) method is a multiscale approach that aims to reduce the computational cost of discrete lattice computations. The method incorporates smallscale local lattice phenomena (e.g. a single lattice defect) in macroscale simulations. Since the method works directly and only on the beam lattice, QC frameworks do not require the construction and calibration of an accompanying continuum model (e.g. a cosserat/micropolar description). Furthermore, no coupling procedures are required between the regions of interest in which the beam lattice is fully resolved and coarse domains in which the lattice is effectively homogenized. Hence, the method is relatively straightforward to implement and calibrate. In this contribution, four variants of the QC method are investigated for their use for planar beam lattices which can also experience out-of-plane deformation. The different frameworks are compared to the direct lattice computations for three truly multiscale test cases in which a single lattice defect is present in an otherwise perfectly regular beam lattice.

Key words: quasicontinuum method, multiscale, beam, beam lattice, beam model, lattice model, network model, discrete model, cosserat, micropolar, mixed formulation

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