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The evolution of spatial distribution patterns of rigid porphyroclasts under pure and simple shear

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Rock strain can be inferred by analyzing the spatial correlation of rock elements that were strongly anticlustered and exhibited an isotropic arrangement prior to deformation (Fry, 1979). The question arises as to whether this technique can be applied for non-densely packed aggregates of relatively strong particles such as porphyroclasts in shear zones. It has been recognized that mechanical interaction in non-dilute aggregates of rigid particles may introduce substantial perturbations to their trajectories. The goal of this study is to quantify the evolution of spatial correlations among rigid equant particles under pure and simple shear, primarily as a function of particle fraction, and to assess whether the evolving microstructural characteristics could be related to finite strain.
Synthetic tests are performed to check the impact of system size and degree of anticlustering on the quality of strain estimates for simplified systems with passive particles. A modified version of the Delaunay triangulation nearest neighbor method (Mulchrone, 2003) is used.
Numerical simulations were run to calculate the trajectories of cylindrical particles in assemblages of varying fraction under either pure or simple shear in the far field. The steady two-dimensional Stokes equations are used under the creeping flow assumption and gravity effects are neglected. The matrix is treated as an incompressible, isotropic viscous fluid and the particles are rigid. Both cases of either coherent or slipping particle-matrix interfaces are considered. No frictional contacts between the particles are allowed. Double periodic boundary conditions are used.