**Multiscale Computational Scheme for Semi-Analytical Modeling of the Point Contact of Inhomogeneous Materials**

**Category:** Contact Mechanics
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**Abstract:** Semi-analytical models (SAMs) have been developed to analyze contact problems efficiently, including those of inhomogeneous materials, based on the equivalent inclusion method. However, understanding the behavior of microscopic inhomogeneities requires SAMs of even higher efficiency. This study builds a new semi-analytical model for high-speed simulations of contacts of materials containing distributed particles of sizes orders of magnitude smaller than that of the contact radius. The domain decomposition method is applied to construct a two-level mesh set to implement multiscale computation. The macroscopic mesh uses homogenized elements that ensure a high computing efficiency in obtaining the contact pressure distribution as a boundary condition, whereas the material microstructures are modeled using the microscopic mesh, and thus the microscopic stress and strain are obtained. New influence coefficients are derived for eigenstress and eigenstrain calculations in both mesh levels and are used to calculate the eigenstress and equivalent eigenstrains. The new model is implemented to investigate the effects of particle clustering on the contact performances of composites.

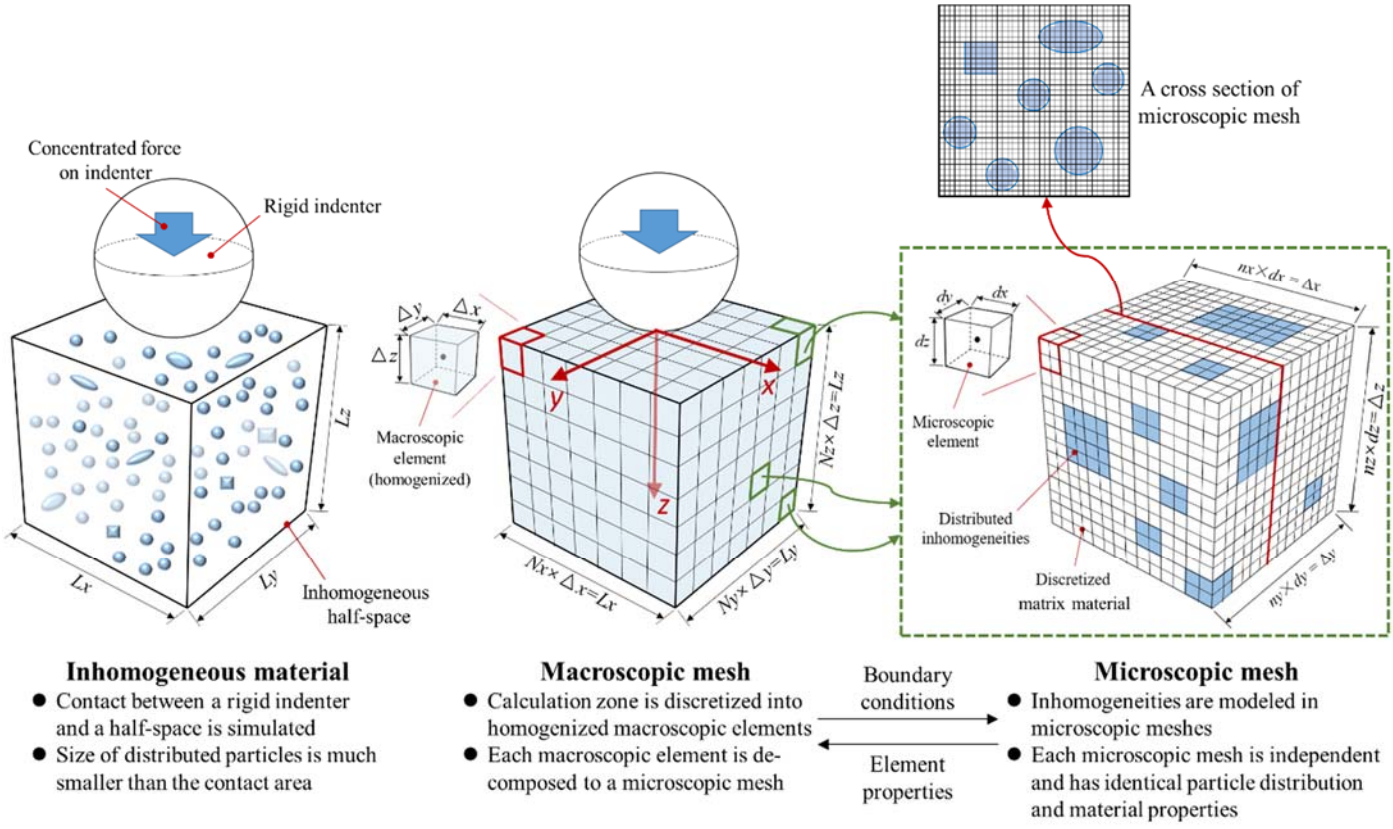


**Fig. 1. Contact involving an inhomogeneous material and schematics of the macro- and microscopic meshes for inhomogeneity treatments.**