Abstract

Internal erosion in soils is characterized by a first step of detachment of solid particles from the granular skeleton under the action of water seepage; then the detached particles are transported with the water flow. For some erosion processes, such as suffusion, transported particles may finally be redeposited within the interstitial space of the soil itself acting as a filter. This paper focuses on the analysis and the description of the two first steps of particle detachment and transport in the cases of erosion by suffusion and piping erosion. The analysis is mainly based on direct numerical simulations performed with a fully coupled discrete element–lattice Boltzmann method. Inter-particle interactions occurring in the solid granular phase are described with the discrete element method, whereas dynamics of the water flow is solved with the lattice Boltzmann method. Simulation results show that internal erosion of the solid phase can be described either from the hydraulic shear stress or from the power expended by the water seepage. The latter description based on the flow power is finally compared with experimental results from laboratory tests.