STUDY OF MICRO-SIZED PARTICLE DEPOSITION USING DEM, CFD-DEM AND SPH APPROACH

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ABSTRACT

Self-assembly and packing of colloids and micro or nano scale particles has become a subject of great interest due to widespread advancement of micro-scale technologies. In this thesis, several numerical analyses are performed to study the packing or self-assembly of micro-sized particles under dry or wet condition. Part one of the thesis is concerned with DEM simulation of micro-sized cohesive granular particles using two history dependent contact models. The simulation results showed that the particles with Gaussian distribution always have the lowest packing density. For cohesive particles, size distributions result in the same tendency of packing density but has much less variation with particle size. In the second part a coupled CFD-DEM method is used to simulate self-assembly of micro-sized particles induced by evaporation. Interesting patterns are seen to emerge as the liquid water film evaporates. In the third part of the thesis low velocity SPH method is used to simulate jamming transition in granular system under cyclic compression. The results obtained show that the average coordination number varies with packing fraction during jamming. Stress relaxation is seen to occur after several compression cycles which is marked by a decrease in coordination number and global pressure. Force distribution shows similar exponential behavior as the average force on the system is increased.