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Micro-mechanics and dynamics of cohesive particle systems

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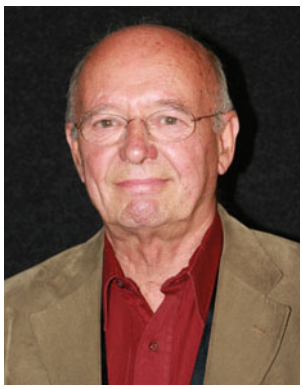

Cohesive particle systems are ubiquitous in nature and industrial applications. Besides the ordinary repulsive interaction between particles, the macroscopic behavior of cohesive systems is determined by attractive interactions between particles, such as van der Waals forces, liquid bridges and electrostatics.

Much insight in the dynamics of cohesive granular materials was obtained by means of discrete element modeling (DEM). First introduced by Cundall and Strack [1], this method offers a robust numerical approach to explore the macroscopic behaviour of granular materials with detailed analysis of particle interactions. As one of the pioneers in DEM, Colin Thornton and his co-workers have advanced DEM significantly, in particular, in modeling cohesive particle systems, e.g. [2–10]. Thornton's work inspired the research in this area significantly.

Cohesive forces in particle systems can be caused by van der Waals interactions [2–9], liquid bridges [10,11] and electrostatic interaction [12]. The systematic investigation of cohesive particle systems was much inspired by the seminal work on impact of elastic spheres with adhesion [2], in which theories of Hertz [13], Mindlin and Deresiewicz [14] were adapted to model the normal and tangential interaction of elastic particles, and the classical JKR model [15,16] was used for modelling the adhesive interaction. In particular, this was used to study the agglomerate breakage during impacts [6,7] and diametrical compression [8] whose implications can be considered as main achievements.

Beginning with the aforementioned pioneering work, the knowledge on cohesive particle systems has progressed dramatically. The present topical issue on "Micro-mechanics and Dynamics of Cohesive Particle Systems" includes ten invited papers addressing the recent development in understanding micro-mechanics and dynamics of cohesive particle systems and reflecting the state of the art in this field. They cover the measurement of motion of particles in cohesive granular systems [17], modeling of adhesion of particles due to van der Waals forces [18,19], rheology [20], dynamics and segregation of wet granular systems [21–23], packing and fluidization of particles with electrostatic and magnetic forces [24,25], and the measurement of the horizontal-to-vertical stress ratio of cohesive powders [26].

The authors and editors of this *Topical Issue* dedicate this volume to their highly esteemed scientific colleague, teacher and personal friend, Prof. Colin Thornton, on the occasion of his 70th birthday.

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