

Einladung zum Seminarvortrag im Aachener Mechanik & Statik Kolloquium

28. Januar 2016; 10:15 – 11:30 Uhr;
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„From particle simulations to continuum theory and applications”

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The dynamic behaviour of granular materials is of considerable interest in a wide range of industries and disciplines (e.g. metallurgy, pharmaceutical, chemical and food processing, civil engineering and geotechnics). The full understanding or control of the different steps and mechanisms of the particle systems, natural phenomena, or process is essential for both science and application.

The fundamentals can be studied by direct particle simulation methods, where often the fluid between the particles is important too, in order to gain a microscopic understanding of the processes and mechanisms. For large-scale applications, a micro-macro transition towards continuum theory is necessary, however, only smaller applications can be modeled nowadays directly by discrete methods. As one example, we use experiments and discrete particle simulations (DEM) to investigate the dosing of cohesive fine powders via coarse, meso-scale particles. Other applications involve chute flow or ring-shear rheology testing of granular flow as well as the study of the elastic, or elasto-plastic material behavior.

The micro-macro transition from discrete particulate systems to continuum theory involves a mathematical homogenization or coarse-graining that translates particle-positions, -velocities and -accelerations into density-, stress-, and strain-fields, by statistical spatial- and temporal averaging.

The macroscopic fields are compatible with the conservation equations for mass and momentum of continuum theory, and also the fluctuating kinetic energy provides a measure for the importance of fluctuations in those systems. The ultimate goal is to find constitutive relations that contain information about the micro-structure and -fluctuations, and to solve those on the macro-level for solving application and optimisation problems.

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