香港科技大學
THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY

土木及環境工程學系
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

SEMINAR

MODELLING COHESIVE POWDER BEHAVIOUR: A DEM APPROACH

Speaker

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Abstract

The behaviour of powders at the bulk scale is fundamentally influenced by microscopic interactions among individual particles and their surrounding media. To predict this behaviour from particle-level properties, the discrete element method (DEM) offers a powerful approach. DEM simulates particle motion based on Newton's laws, incorporating interparticle forces such as mechanical contact, van der Waals, electrostatic, and liquid bridge forces to capture the complex behaviour of cohesive powders. This talk presents a systematic evaluation of DEM models that integrate these forces to predict typical bulk behaviours in cohesive powders. Key aspects are highlighted, including how particle properties influence interactions and their effect on bulk behaviour. Recent advancements in modelling deformable and irregular particles, coupled DEM-fluid simulations (e.g., with CFD and Lattice Boltzmann methods), and emerging applications are also discussed. The talk concludes with an overview of challenges and future perspectives for DEM in modelling powder behaviour.

Biography

Prof. Chuan-Yu (Charley) Wu, a Professor of Chemical Engineering at the University of Surrey, UK, has led two major European consortia—IPROCOM (FP7, 2013–2016, €3.8M) and MATHEGRAM (H2020, 2019–2023, €4.2M)—focusing on computational tools for pharmaceuticals and granular materials. He is an executive editor of Powder Technology, a leading journal in particle systems, and the founding Chief Editor for Frontiers in Chemical Engineering: Materials Process Engineering. He has co-authored the monograph Particle Technology and Engineering (Elsevier, 2016) and edited two influential books, Discrete Element Modelling of Particulate Media and Particulate Materials: Synthesis, Characterisation, Processing, and Modelling (RSC Publishing). Prof. Wu has published over 160 scientific papers and delivered more than 100 invited presentations globally. He serves on the advisory and editorial boards of esteemed journals, including Particuology, Acta Pharmaceutica Sinica B (APSB), and the Journal of Engineering.

His expertise lies in discrete element methods, finite element analysis, and simulations, particularly in pharmaceutical engineering, particle technology, and granular materials. For over two decades, Prof. Wu has collaborated with leading global companies to advance numerical modelling techniques for pharmaceutical and fine chemical manufacturing, with support from major pharmaceutical companies such as Pfizer, AstraZeneca, Genentech, Sanofi, Janssen, and MSD, as well as funding from the EPSRC and the EU.

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