

GRANULAR AND MULTIPHASE FLOWS

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The Granular Science Laboratory

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Using DEM to Develop Constitutive Models for CFD Simulations of Granular Flows

Granular processes pervade the chemical, pharmaceutical, agricultural and mining industries. Many of these processes have significant opportunities for cost savings and productivity enhancements. However, advances are currently unrealized due to the lack of understanding of particle flow behavior in industrial scale processes. Reliable simulation tools can aid in this understanding and accelerate the achievement of substantial process improvements. Recent advancements in multiphase computational fluid dynamics (CFD) can help facilitate these improvements. In multiphase CFD, in all but extremely dilute flows, the particle phase is treated as a continuum and constitutive models are necessary to describe the effective particle-phase stress. However, state-of-the-art, multiphase CFD is currently limited due to the lack of constitutive models that adequately describe the range of particle characteristics (particle shape, particle size/size distribution, etc.) in a typical particle mix.

In this talk, I will show how discrete element method (DEM) simulations, which describe the detailed motion of individual particles, are used to develop and test constitutive models employed in multiphase CFD codes.

Jennifer Sinclair Curtis is Professor in the Chemical Engineering Department at the University of Florida. Prior to this, she held administrative roles as Department Chair of Chemical Engineering at UF and Associate Dean of Engineering and Department Head of Freshman Engineering at Purdue University. Professor Curtis received a B.S. in Chemical Engineering from Purdue University (1983) and a PhD in Chemical Engineering from Princeton University (1989). She has an internationally-recognized research program in the development and validation of numerical models for the prediction of particle flow phenomena. She is the co-author of over 100 publications and has given over 160 invited lectures at universities, companies, government laboratories and technical conferences. Professor Curtis is a recipient of a Fulbright Research Scholar Award, a NSF Presidential Young Investigator Award, the American Society of Engineering Education's (ASEE) Chemical Engineering Lectureship Award, the Eminent Overseas Lectureship Award by the Institution of Engineers in Australia, the ASEE's Sharon Keillor Award for Women in Engineering, and the AIChE Fluidization Lectureship Award. She currently serves as Associate Editor of the *AIChE Journal* and on the Editorial Advisory Board of *Powder Technology* and *Chemical Engineering Education*. She has served on the National Academy of Engineering's (NAE) Committee on Engineering Education and has participated in two NAE Frontiers of Research Symposia (2003 and 2008). Currently, she is a Board member of the National Academies' Chemical Science Roundtable, as well as the Council for Chemical Research and the American Institute of Chemical Engineers.