Particle Scale Modelling and Analysis of Complex Particle-fluid Flows

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Particle science and technology is a rapidly developing interdisciplinary research area with its core being the understanding of the relationships between micro- and macro-scopic properties of particulate/granular matter – a state of matter that is widely encountered but poorly understood. The macroscopic behaviour of particulate matter is controlled by the interactions between individual particles as well as interactions with surrounding gas or liquid and wall. Understanding the microscopic mechanisms in terms of these interaction forces is therefore key to leading to truly interdisciplinary research into particulate matter and producing results that can be generally used. This aim can be effectively achieved via particle scale research based on detailed microdynamic information such as the forces acting on and trajectories of individual particles in a considered system. In recent years, such research has been rapidly developed worldwide, mainly as a result of the rapid development of discrete particle simulation technique and computer technology. This talk will present an overview of the work in this direction in my laboratory SIMPAS. It covers the theoretical developments and case studies under different conditions. Focus will be given to the recent developments in this area, particularly for complex particle-fluid flow systems such as cyclones, three-dimensional fluidization and heat transfer, pneumatic conveying, and industrial applications. The examples will demonstrate that particle scale approach has gradually emerged to be a powerful tool not only for fundamental research but also for engineering application. Finally, areas for future development are briefly discussed.

Brief Biography

Aibing Yu specialized in process metallurgy, obtaining BEng in 1982 and MEng in 1985 from Northeastern University, PhD in 1990 from the University of Wollongong, and DSc in 2007 from the University of New South Wales (UNSW). He is currently Vice-Chancellor's Professorial Fellow, Pro Vice-Chancellor and President (Monash-Suzhou), Monash University, after 22 years with UNSW. He has been Inaugural Director of a world-class research facility "Simulation and Modelling of Particulate Systems (SIMPAS)". He is also Founding Director of Australia-China Joint Research Centre for Minerals, Metallurgy and Materials (ACJRC 3-M), Director of ARC Research Hub for Computational Particle Technology, and Chair of Technical Advisory Committee of Baosteel-Australia University Joint Research Centre.

He is a world-leading scientist in particle/powder technology and process engineering, has authored >800 publications (including >500 articles collected in the ISI Web of Science), organized numerous international and domestic conferences, delivered many plenary/keynote presentations at different international conferences, and graduated >30 postdoc fellows and >60 PhD students. He is Editor, Powder Technology (2013-) and Particuology (2008-2013), has guest-edited for a number of journals, and has been on the editorial board of about 20 learned journals.

He is a recipient of various prestigious fellowships and awards, including ARC Australian Professorial (2005-2009) and Federation (2008-13) Fellowships, the Josef Kapitan Ironmaking Award from the Iron and Steel Society, USA (2002), Ian Wark Medal and Lecture from Australian Academy of Science (2010), and ExxonMobil Award from Australian and New Zealand Federation of Chemical Engineers (2010). He is a Fellow of Australian Academy of Science (AAS), Australian Academy of Technological Sciences and Engineering (ATSE), Royal Society of New South Wales (RSNSW), and Institution of Chemical Engineers (IChemE).