

Breakfast cereals to sand castles: the ubiquity of particulate solids

Inaugural Lecture - Professor Jin Y. Ooi
Chair in Particulate Solid Mechanics

Lecture Details

5.15pm on Friday, 22 September 2006
Swann Lecture Theatre
The King's Buildings
Edinburgh

The lecture will be followed by a reception.

Abstract

Granular or particulate materials are everywhere! A quick rummage through the kitchen cupboards turns up flour, sugar, salt, breakfast cereals, washing powder and pasta shapes. A medicine cabinet can reveal an array of tablets, which often consist of densely packed particulate solids inside. Many more products are delivered in particulate form, because of its easy storage, easy quantity measurement and also because compounds, such as certain medications, need to be supplied in precisely combined doses.

The route for a particulate based product to reach the market often involves solving the significant challenge of designing the handling and processing plant. Currently, the lack of effective design methodology has resulted in extensive use of pilot plants which are both expensive and time consuming. The lack of understanding of design parameters that control the behaviour of these particulate products frequently causes unintended defects in the process, such as abrasion of process vessel walls, poor bulk flow, low product quality due to segregation of grain sizes, caking and degradation during processing. With an increasing number of new particulate-based products being developed, notably in the pharmaceutical, healthcare and food industries, there is a real need to develop predictive tools to provide a step change in the technology for the bulk handling of particles. These 'modern' particles are much more complex, both in composition and in shape, than the glass beads and sands, the study of which has so far been the prime basis of our understanding of granular mechanics.

It has been estimated that over 75% of the raw materials that pass through industry are particulate or powder in nature (Nedderman, 1992). Many of these industrial solids display difficult handling behaviours, giving rise to considerable challenges in the design and operation of the handling and processing plants.

In this lecture, Prof Ooi will draw on numerous particulate solids encounters that we each have in our daily lives and comment on the various fascinating facets of their characteristics. He will then describe some recent fundamental and industrial research relating to the flow, storage and handling of particulate solids and powders, highlighting recent studies conducted at Edinburgh. He will conclude with thoughts and reflections on the challenges ahead.

Professor Jin Y. Ooi - a short biography

Jin Ooi joined the University of Edinburgh in 1990 and is currently the Professor of Particulate Solid Mechanics. Prior to Edinburgh, he obtained his BEng (Hons) degree in civil engineering from the University of Auckland in 1985 and his PhD in bulk solids handling from the University of Sydney in 1990.

Prof. Ooi's principal research interests lie in the mechanics and dynamics of granular solids and powders, with special reference to solids stored in silos and hoppers. His research covers both computational and experimental studies in pursuit of new insights into the behaviour of particulate systems, and he exploits these insights to address a variety of industrial problems. A few recent examples include design of two industrial testers for cohesive solids that are being used in several countries, evaluation of some iron ore silos with over 100,000 tonnes capacity each and the co-founding of a spin-out particle dynamics software company. Support for his work of over £2M to date has come from EPSRC, DTI, EU, BCURA and industry.

Prof Ooi was recently Chair of the Granular Materials Technical Committee of the American Society of Civil Engineers (ASCE) and Associate Editor for the highly regarded ASCE Journal of Engineering Mechanics. He is currently serving his third term in the EPSRC Peer Review College. He has served on scientific committees and chaired technical sessions for many international conferences, and has been invited to deliver lectures at numerous conferences/meetings. With over 100 publications, Prof. Ooi aims to continue to contribute strongly to developing new understanding and novel applications in particulate systems.