



DEPARTMENT OF CIVIL ENGINEERING

DISTINGUISHED PUBLIC LECTURE (ONLINE)

The Breakage Mechanics of Granular Systems

Professor Itai Einav

Professor and Director of SciGEM, The University of Sydney

Date: July 16, 2020 (Thursday)

Time: 5:00 p.m. (Hong Kong Time)

7:00 p.m. (Sydney Time)

Zoom: <https://hku.zoom.us/j/93996209490?pwd=M0ViRWZ3c2ZtU0FRY1RmWlk0NWQxUT09>
(Meeting ID: 939 9620 9490, Password: 845089)**Abstract**

This lecture will review the development of continuum mechanics principles for comminution – the process of grainsize variations through crushing and grinding. To examine confined systems, where particles crush without substantial mass flow, the lecture will start by detailing the mathematical building blocks of the breakage mechanics theory (BMT). Before this continuum theory most other comminution models were either largely empirical or based on large computer simulations that followed the motion and fragmentation of every single grain in a system. Such simulations can normally cope with less than a handful of sand particles, more than a billion times less than most real problems in geotechnology and mineral processing. On the other hand, using BMT one can directly predict the coupling between comminution and mechanics by solving differential equations that require significantly less computational power than discrete approaches so are solvable for realistic system sizes. A few examples for large-scale solution will be reviewed, including the bearing capacity of piles in sand and block cave mining. BMT is idealised for closed granular systems and does not apply to open systems, which involve particle mixing and segregation fluxes from neighbouring volumes. So comminution in problems such as grinding in mineral processing and landslides need to follow an alternative approach. To this end, my group and I have recently pioneered a new theoretical paradigm to handle grain crushing in open systems. The breakthrough was our notion of multi-scale heterarchy, which allows us to retain the grainsize fabric from first principles without violating grainsize-dependent conservation laws. The lecture will conclude by highlighting the advantageous of this new general approach.

About the Speaker

Itai Einav is working at the University of Sydney as a professor of geomechanics and as the director of Sydney Centre in Geomechanics and Mining Materials (SciGEM). His research diversely translates concepts from mathematics and physics to engineering, and vice versa. It encompasses the development of novel x-ray technologies for recovering kinematics in fast flowing granular media, the hydrodynamics of saturated and unsaturated soils, and the physical origin of geotechnical failures and natural disasters such as earthquake faulting, landslides and avalanches. Itai has been recognised through many awards, including the ALERT Geomaterials Medal and the George Stephenson Medal for his pioneering work on breakage mechanics. A standout is his continuous record of articles on fundamental science, in journals including those in the Science and Nature families, and publications with peak bodies: the Royal Society of London, American Physical Society, and American Geophysical Union.

FREE ADMISSION - ALL ARE WELCOME

Registration is required only for participants who require attendance certificate:**https://hkuems1.hku.hk/hkuems/ec_hdetail.aspx?guest=Y&ueid=70237****An electronic certificate of attendance will be issued to registered participants after the public lecture.**