



**Talk on “Coupled Fluid-Particle Modelling of Debris Flow”**  
by Dr Gue Chang Shin

Dr. Gue Chang Shin is currently a Committee Member of IEM Geotechnical Engineering Technical Division (GETD).

It was an honour for the Geotechnical Engineering Technical Division (GETD) of IEM, to have Dr. Fiona Kwok of University of Hong Kong, to deliver an IEM GETD evening technical talk on “Coupled Fluid-Particle Modelling of Debris Flow” at the Tan Sri Prof. Chin Fung Kee Auditorium, Wisma IEM on 18<sup>th</sup> September 2015. The talk was chaired by Dr. Gue Chang Shin.

Dr. Fiona Kwok started with enlightening the audience that debris flow is one of the most destructive natural hazards that can mobilise large volume with rapid long run-out distance and impact forces. She stressed that a debris flow event is a multiphase flow that includes a viscous fluid phase with dynamic surface and solid grains with various particle sizes, where complex interactions take place between the multi phases. The behaviour of the multiphase debris flow is very challenging as the particle-fluid and particle-particle interactions of a debris flow event take place by means of slide and collision.

She then moved on to the current state-of-the-art research study on computational fluid dynamics and discrete element method (CFD-DEM)(Figure 1). This method is extended with the volume of fluid method to model free surface flows that is applicable in Geotechnical Engineering, such as debris flows. The essence of this method is in the coupling and data exchanging of CFD and DEM by means of updating the drag force and buoyancy from CFD to DEM and assembling the momentum source and updating the porosity from DEM to CFD. Dr. Fiona Kwok mesmerised the audience by showing some of the animations of the CFD-DEM modelling.

The speaker continued the talk on physical modelling of debris flow (Figure 2), for calibrating the numerical model and to investigate on how particles influence the flow. Parametric studies were carried out to look into the mechanism involved in the debris flow and its deposition, such as the slope angle, channel roughness, fluid properties and etc. The audience were enlightened with some video clips of the physical modelling involved in study. Dr. Fiona Kwok then explained the mechanism involved in a debris flow event such as kinetic sieving (percolation, upward migration) and squeezing expulsion where large particles can be expelled towards the surface of the flow and preferentially transported to the front. Flow materials will pass over the front and buried by following materials, in which this process involves a recirculation mechanism.

Dr. Fiona Kwok stressed that the research is still on-going where work is continuing on using the developed tools to understand the mechanism of more complicated geotechnical engineering problems such as grain segregation in debris flows. The talk ended with rounds of applause from the audience and the appreciation momento was presented by the Chairman of GETD, Ir. Yee Thien Seng to Dr. Fiona Kwok (Figure 3).

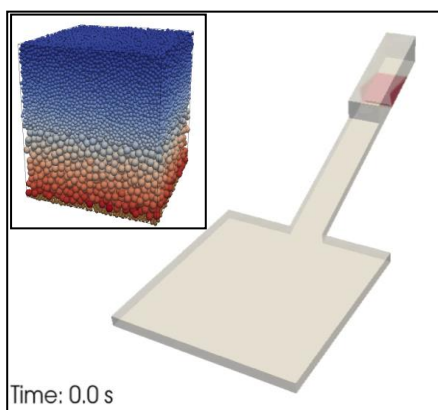


Figure 1: Numerical modelling (Extended CFD-DEM)

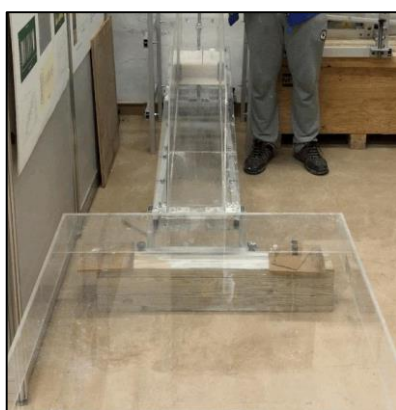


Figure 2: Physical modelling



Figure 3: Appreciation momento presented by GETD Chairman Ir. Yee Thien Seng to Dr. Fiona Kwok