The Institute of Materials, Minerals and Mining
HONG KONG BRANCH

Technical Seminar

Applications of 3D Printing Method in Rock Mechanics

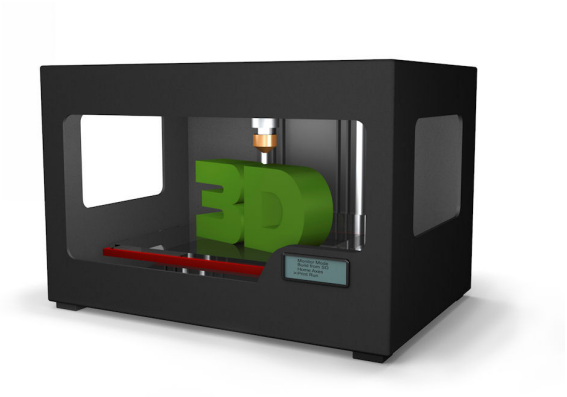
29 November 2016 (Tuesday)

Supported by

Department of Civil and Environmental Engineering, PolyU

Programme Highlights:

Over thirty years into its development, three-dimensional printing (3DP) has been widely applied in biomedicine, materials science, and aerospace etc. 3DP builds up objects by fabricating parts layer upon layer based on a computerized 3D model data. It has advantages over conventional manufacturing in fast preparation, high repeatability, and fabricating objects with complex structures. In this research, we studied the application of 3DP in rock mechanics. First, static uniaxial compression tests were performed to identify a suitable 3DP material from ceramics, gypsum, PMMA, resin and SR20 for simulating brittle and hard rocks. Experimental results indicated that the 3DP resin produced via stereolithography (SLA) method was the most suitable 3DP material for mimicking rocks, although its brittleness needs to be improved. Subsequently, three methods including freezing, incorporation of internal macrocrack and addition of micro-defects were adopted to improve the brittleness of the 3DP resin. Second, the micro-computerized tomography (micro-CT), 3D reconstruction and SLA techniques were adopted to replicate natural volcanic rocks. Static and dynamic tests were, subsequently, performed on these 3DP rocks to study their mechanical and fracturing properties. Experimental results indicated that the mechanical properties, i.e., dynamic strength and Poisson's ratio, and fracturing process of the 3DP artificial rocks agreed well with those of the prototype volcanic rocks. Lastly, the effects of 3D internal flaws and loading conditions on the mechanical and fracturing properties were explored. The results revealed that the flaw numbers and loading conditions greatly affected the



compression strength and axial deformation of the 3DP resin specimens. 3D crack growth was more complicated under static loading than that under dynamic loading. Our studies showed that the innovative approach of incorporating micro-CT and SLA 3DP techniques provides new insight into studying mechanical and fracturing properties of rocks.

This technique also illustrates another great example of crossover technology utilization in this area of interest.

Speaker:

Dr Zhu is an Assistant Professor of Rock Mechanics in the Department of Civil and Environmental Engineering, The Hong Kong Polytechnic University. He got his bachelor and master degrees from Sichuan University in 2005 and 2008, respectively, and PhD degree at Swiss Federal Institute of Technology Lausanne (EPFL) in 2011. Before joining PolyU in 2013, he was a postdoctoral scholar at the California Institute of Technology. He teaches subjects on rock mechanics and engineering. His research interests include rock caverning, rock dynamics and induced earthquakes. He has authored over 50 papers including over 20 in international journals. He was awarded the Fellowship for Prospective Researchers from Swiss National Science Foundation. He is a member and Editorial Board and Guest Editor of Rock Mechanics and Rock Engineering journal, Springer. He also served as member of Rock Dynamics Commission of International Society or Rock Mechanics, and Rock Dynamics committee, Protective Engineering Committee, Youth Committee and Underground Engineering Committee of Chinese Society of Rock Mechanics and Engineering, and Council of the Institute of Materials, Minerals and Mining (Hong Kong Branch).

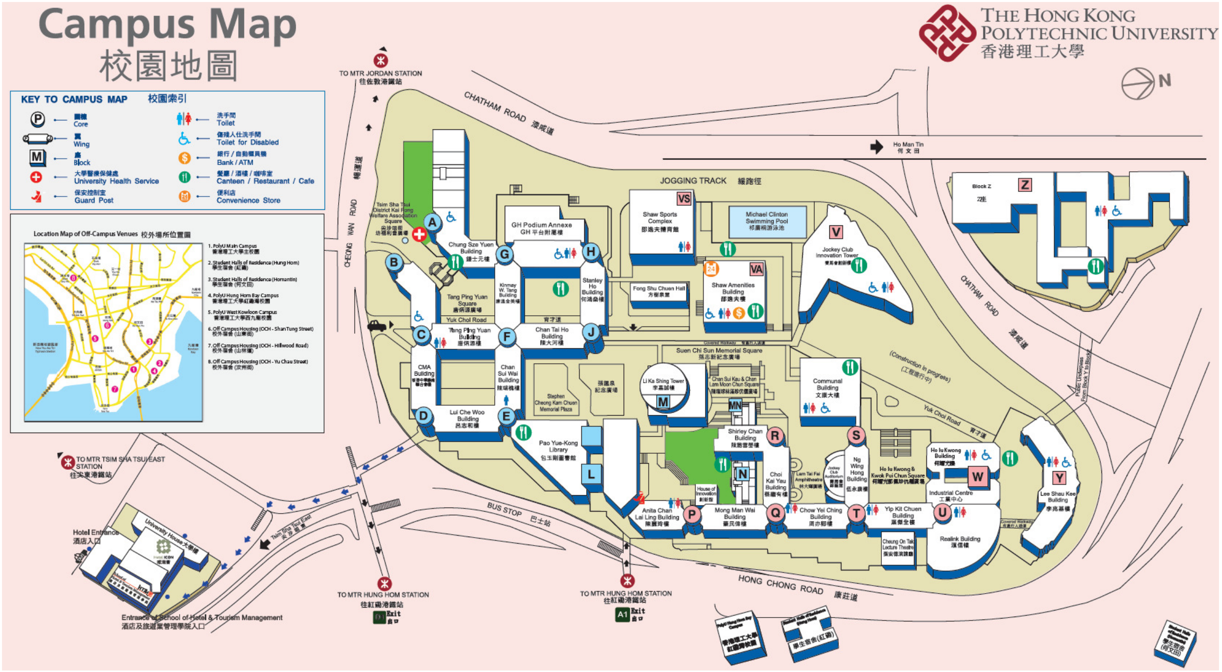
Time: 19:00-20:30

Venue: Room Z414, The Hong Kong Polytechnic University.

Registration and Enquiries:

Free of Charge. No prior registration is required. For enquiries, please contact Mr. Kelvin Choi, Honorary Secretary of IOM^3 (HK) at kelvin.choi@dragageshk.com

Certificate of Attendance (1.5 hrs) for Continuing Professional Development (CPD) will be provided at the end of the event.


Campus Map
校園地圖
THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學
N
KEY TO CAMPUS MAP 校園索引
Core
Wing
Block
University Health Service
Guard Post
Toilet
Toilet for Disabled
Bank / ATM
Canteen / Restaurant / Cafe
Convenience Store
Location Map of Off-Campus Venues 校外場所位置圖
TO MTR JORDAN STATION
CHATHAM ROAD
Ho Man Tin
JOGGING TRACK
CHEONG WAN ROAD
Chung Sze Yuen Building
GH Podium Annexe
Shaw Sports Complex
Michael Clinton Swimming Pool
Jockey Club Innovation Tower
Tang Ping Yuen Square
Kinmay W. Tang Building
Stanley Ho Building
Fong Shu Chuen Hall
Shaw Amenities Building
Yuk Choi Road
Tang Ping Yuen Building
Chan Tai Ho Building
Suen Chi Sun Memorial Square
CMA Building
Chan Sui Wai Building
Li Ka Shing Tower
Communal Building
Lui Che Woo Building
Pao Yue-Kong Library
Shirley Chan Building
Choi Kai Yau Building
Ng Wing Hong Building
Ho Iu Kwong Building
Industrial Centre
Lee Shau Kee Building
Block Z
Anita Chan Lai Ling Building
Mong Man Wai Building
Chow Yei Ching Building
Yip Kit Chuen Building
Cheung On Tak Lecture Theatre
Rosalink Building
BUS STOP
HONG CHONG ROAD
TO MTR TSIM SHA TSUI EAST STATION
Hotel Entrance
TO MTR HUNG HOM STATION
Entrance of School of Hotel & Tourism Management