



Department of Civil Engineering
The University of Hong Kong

Distinguished Public Lecture

Multi-phasic Approaches for Estimating the Hydro-Mechanical Properties of Heterogeneous Rocks

 Date: June 13, 2023 (Tuesday)

 Time: 4:00 pm to 5:00 pm

 Venue: Room 612B, 6/F Haking Wong Building,
The University of Hong Kong

Professor A.P.S. Selvadurai

Department of Civil Engineering and Applied Mechanics
McGill University, Canada



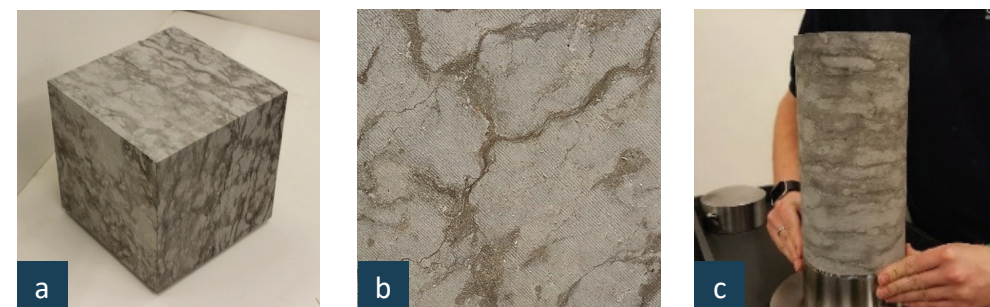
Abstract

Rocks with heterogeneity always pose a great challenge when attempting to determine the geomechanical properties relevant to geotechnical applications. An improper selection a representative volume element for performing geotechnical testing can lead to inaccuracies. This lecture will focus on the application of multi-phasic approaches that can provide an alternative approach for estimating geomaterial properties of heterogeneous geologic media. The application is relevant to the visually heterogeneous Cobourg limestone found in southern Ontario, Canada, which has been proposed as a potential deep geological formation for the storage of low-intermediate level nuclear fuel waste. The hydro-mechanical couplings in this low permeability rock is important in connection with the assessment of distress to underground openings. The application of Biot's theory of poroelasticity requires the estimation of the Biot coefficient, which controls the stress partitioning. The experimental estimation of the Biot coefficient for the Cobourg limestone is difficult because of the very low permeability of the rock, which makes the saturation a time consuming process. The lecture shows the application of multi-phasic theories can provide a useful alternative approach for estimation the Biot coefficient. The permeability of the heterogeneous Cobourg limestone is influenced by the calcite rich lighter nodular regions and the calcite, dolomite, quartz rich darker partings with a nominal clay fraction. The multiphasic approach enables the estimation of the effective permeability of the Cobourg limestone.

About the Speaker

Dr. A.P.S. Selvadurai is currently *William Scott Professor and Distinguished James McGill Professor* in the Department of Civil Engineering and Applied Mechanics. He obtained his Ph.D. degree in Theoretical Mechanics from the University of Nottingham, under the tutelage of the eminent continuum mechanist the late Professor A.J.M. Spencer FRS and in 1986 the D.Sc. in Theoretical Mechanics for research into "*Mathematical Modelling of Problems in Geomechanics and Elastomechanics*". He joined the Department of Civil Engineering at Carleton University, Ottawa, Canada in 1975 as Assistant Professor, became Professor in 1981 and Head of the Department from 1982 to 1991. From 1993 to 1997, he was Chair of the Department of Civil Engineering and Applied Mechanics at McGill University. He has had Visiting Professorships at the Division of Theoretical Mechanics, University of Nottingham, U.K; Laboratoire 3S, Université Joseph Fourier, Grenoble, France; The Department of Civil Engineering, University of Canterbury, Christchurch, New Zealand; The Department of Civil and Structural Engineering, Polytechnic University, Hong Kong, China; The School of Civil and Environmental Engineering, University of New South Wales, Sydney, Australia, Département de Génie Civil, École Polytechnique Fédérale de Lausanne, Switzerland, The Department of Civil Engineering and Geosciences, The Technical University of Delft, The Netherlands, an International Chair at the Université Libre de Bruxelles, Belgium and CAPES (Special Senior Visitor) at the Departamento de Engenharia Civil, Pontificade Universita Catolica, Rio de Janeiro, Brazil.

Dr. Selvadurai is recognized as a world leader in continuum mechanics, theoretical, computational and experimental geomechanics and applied mathematics. His research includes the mechanics of elastic media undergoing large deformations, fracture mechanics, micromechanics of inclusions and defects, poroelasticity, coupled thermo-hydro-mechanical processes in deformable media, mechanics of inhomogeneous media, interfaces in geomechanics, fragmentation of brittle



The fabric of the Cobourg limestone. (a) Cuboidal region 300 mm, (b) The lighter nodular features and the darker argillaceous partings over a 100 mm x 120 mm area (c) Large Triaxial specimen 150 mm diameter.

geomaterials, transport in porous media and mechanics of geosynthetics subjected to chemical exposure. These studies have profoundly influenced engineering activities related to nuclear waste management, soil-structure interaction and northern geomechanics associated with offshore structures and buried pipelines and environmental geomechanics. He has published extensively in archival journals devoted to applied mechanics, geomechanics, applied mathematics, computational mechanics and experimental mechanics. He is the author or co-author of texts devoted to *Elastic Analysis of Soil-Foundation Interaction* (Elsevier, 1979), *Elasticity and Geomechanics* (with R.O. Davis) (Cambridge University Press, 1996), *Partial Differential Equations in Mechanics Vols. 1&2* (Springer-Verlag, 2000); *Plasticity and Geomechanics* (with R.O. Davis) (Cambridge University Press, 2002), *Transport in Porous Media* (with Y. Ichikawa) (Springer-Verlag, 2012) and *Thermo-Poroelasticity and Geomechanics* (with A.P. Suvorov) (Cambridge University Press, 2016). He serves on the Editorial Boards of nine leading International Journals devoted to *Geomechanics*, *Applied Mechanics*, *Computational Mechanics* and *Engineering Mathematics*. He is a Fellow of the following Academies and Learned Societies: *The Royal Society of Canada*, *The Canadian Academy of Engineering*, *The Engineering Institute of Canada*, *The American Academy of Mechanics*, *The Canadian Society for Civil Engineering* and *The Institute for Mathematics Applications and its Applications* (UK).



Registration is required only for participants who require attendance certificate:
https://hkuems1.hku.hk/hkuems/ec_hdetail.asp?guest=Y&ueid=87675

An electronic certificate of attendance will be issued to registered participants after the public lecture.



FREE ADMISSION
ALL ARE WELCOME