



Department of Mathematics

Faculty of Nuclear Sciences and Physical Engineering
Czech Technical University in Prague

Fluid Flow, Transport and Phase Transitions with Environmental Applications

January 19, 2023

Venue

Fakulta jaderná a fyzikálně inženýrská
České vysoké učení technické v Praze
Trojanova 13
120 00 Praha 2
Room T-101

Programme

- 14:00 - 15:10 **Tissa H. Illangasekare:** Multi-scale Experimentation for Improved Understanding of Energy, Mass and Momentum Transfer Across Interfaces in Natural Systems - Challenges and Opportunities
- 15:10 - 15:45 **Peter Frolkovič:** Semi-implicit numerical schemes for some conservation laws and level set problems
- 15:45 - 16:00 Break
- 16:00 - 16:35 **Michal Beneš, Alexandr Žák:** Microscale model of soil freezing
- 16:35 - 17:10 **Klára Jurčáková:** Wind tunnel modelling of atmospheric boundary layer
- 17:10 - 17:45 **Jakub Šístek:** Domain decomposition solver for immersed boundary finite element method



Tissa Illangasekare
Thursday, January 19, 2023
14:00 in room T-101

Multi-scale Experimentation for Improved Understanding of Energy, Mass and Momentum Transfer Across Interfaces in Natural Systems - Challenges and Opportunities

Tissa Illangasekare, PhD, PE, P. Hyd., BCEE, DWRE

*AMAX Endowed Distinguished Chair of Civil and Environmental Engineering and Director of Experimental Study of Subsurface Environmental Processes, Colorado School of Mines, Golden, Colorado, USA
Research Affiliate, Lawrence Berkeley National Laboratory, Berkeley, California, USA*

Meeting the increasing needs of a growing world population, exacerbated by climate change, will continually challenge water and environmental scientists and engineers for years to come. Theoretical, modeling, computational advances, and monitoring and characterization technologies will help meet some of these challenges. Field and laboratory studies for conceptualization, hypothesis testing, and modeling have continued to advance the sciences. However, the data to study some problems cannot always be obtained in the field where many factors contribute to the uncertainty of measurements and model parameter estimates. The primary thesis of this talk is that laboratory experiments conducted at multiple test scales in conjunction with multi-scale models will provide new insights into complex processes and accurate data for reliable predictions. Design and implementation of theory-driven experiments from examples of groundwater contamination, carbon dioxide storage to mitigate global warming, and land/atmospheric interactions applied to food security are presented to show how advances can be made for practical problem solutions. A case is made that addressing water and environmental problems requires laboratory and field studies and modeling interaction. Further, water and environmental scientists and engineers must work in multidisciplinary teams at the disciplinary interfaces of earth, water, energy, and the environment to address current and emerging local and global problems of water and the environment.

Tissa Illangasekare has a PhD. in Civil Engineering from Colorado State University and an Honorary Doctorate in Science and Technology from Uppsala University. He is a Fellow of the American Geophysical Union (AGU), American Association for Advancement of Science (AAAS), American Society of Civil Engineers (ASCE), Soil Science Society of America (SSSA), the National Academy of Science of Sri Lanka (SLNAS), and a foreign member of the National Academy of Europe. He is the recipient of the 2012 Darcy Medal from the European Geosciences Union (EGU) and the 2015 AGU's Langbein Lecture Award in recognition of lifetime contributions to the science of hydrology. In 2016 he received the 7th Prince Sultan Bin Abdulaziz International Groundwater Prize at the United Nations from Secretary-General Ban Ki-Moon. He was appointed to the Nuclear Waste Technology Review Board (NWTRB) by President Obama in 2016. He was the past editor of *Water Resources Research* and *Earth Science Review* and the past co-editor of *Vadose Zone Journal*. He serves as an editor of *AGU Advances*, *AGU Perspectives of Earth and Planetary Scientists*, and Specialty Chief Editor of *Water and Human Health of Frontiers in Water*. He was a past President of the International Society of Porous Media (InterPore). Professor Illangasekare's research experience and expertise are in numerical modeling and experimentation of flow and transport in porous and fractured media, unsaturated and saturated zone processes, arctic hydrology, land-atmospheric interaction, multiphase flow, carbon storage, aquifer remediation, physical modeling of flow and transport and sensor technologies for environmental applications.