SIMUREX 2018 - Plenary Sessions

PHD Scientific School / INES and Aussois, France, 15-19 of October 2018

Monday 15th of October

Nathan Mendes: Modeling Heat, Air and Moisture in Buildings

History of HAM Modelling, State-of-the-art achievements and some insight for future.

Nathan Mendes is Professor at Pontifical Catholic University of Parana (PUCPR) in Brésil. His research interest focus on building performance modelling, including HAM Transfers.

Dusan Licina: Air quality in the built environment.

Buildings represent habitats for various airborne pollutants, including bioaerosols that have direct or indirect effects on the quality of our living spaces, health, and well-being. People spend majority of their time in buildings, where air pollutant levels often surpass outdoor levels, owing to indoor releases of pollution into the air. Exposure to elevated air pollutant levels is correlated with impaired productivity and detrimental or even lethal health outcomes. Therefore, understanding exposure to airborne pollutants indoors is crucial for interpreting the health risks associated with indoor air quality and for developing improved building control measures to mitigate human exposure. In this lecture, Dusan Licina will review state-of-the-art empirical knowledge on the topic of air quality in the built environment. Three major challenges will be introduced, which are characterization of sources of air pollution in buildings, reliable human exposure assessment, and development of efficient exposure control technologies. These challenges are crucial successful design and operation of an energy efficient and sustainable building that contribute to "outstanding" indoor air quality.

Assist. Prof. **Dusan Licina** is the Head of the Human-Oriented Built Environment Lab (HOBEL) in School of Architecture, Civil and Environmental Engineering (ENAC) at École polytechnique fédérale de Lausanne (EPFL), Switzerland.

Tuesday 16th of October

Aude Pommeret: Topics in energy economics

The talk is organised as follows:
1. Introduction to economics
2. Energy demand (including « energy paradox » and « rebound effect »)
3. NPVs (Net Present Values)
4. Application to solar panel adoption

References:
Kolstadt C.D. : *Environmental Economics*, Oxford University Press, 2000, 2010.
Perman R., Ma Y. and McGuilvray J. : *Natural Resources and Environmental Economics*, Pearson Education 3d ed., 2003
Tietenberg T. and Lewis L. : Environmental Economics and Policy, Pearson Education, 6th ed

Aude Pommeret is a professor in Economics, with a special interest for energy and environmental economics. She has been a faculty at the School of Energy and Environment at City University of Hong Kong for three years is now head of the European Master in Business Studies at University Savoie Mont Blanc. She is also a consultant for the French government at France Stratégie for energy and environmental topics. She has been publishing in top journals and is co-editor of "Resource and Energy Economics".

Thierry Duforestel: Reliability of moisture related approaches in building design

This presentation proposes to discuss the main reasons which can explain the discrepancies which currently appear when simulation and experimental results are compared : the water vapour permeability underestimation and the non-consideration of the sorption hysteresis impact.

Thierry Duforestel is a senior researcher at EDF R&D and Director of the joint laboratory 4evLab (with La Rochelle University and CNRS). For more than 30 years he has been involved in the domain of heat, air and moisture transfers in the context of building energy efficiency. For some years, his main application domain is the high performance renovation of buildings.

Wednesday 17th of October

Christina Hopfe: Addressing uncertainties in building performance simulation to enable informed decision making

After revisiting the basics of uncertainty in Building Simulation, the talk will discuss ongoing work at Loughborough University focusing on uncertainty and sensitivity analysis in building design, performance modelling, optimization and decision-making.

Dr **Christina Hopfe** (FHEA CEng FCIBSE, CEPH) is Reader (Assoc-Prof) in Low Energy Design. Christina has co-authored over 100 peer-reviewed papers, books and book chapters. She is the RAEng Director of Excellence for Sustainable Building Design at LU, chair of IBPSA's communication committee, and a Director-at Large of IBPSA World. She is co-author and co-editor of the 'Passivhaus designers manual', shortlisted as one of Routledge's bestselling books in architecture in 2017.

Frederic Wurtz: Towards a global optimisation of buildings integrated in eco-districts : from design to anticipative and reactive management in the perspective of the Internet of Energy

The presentation will focus on methodologies using physical models and optimization for smart design and smart supervision and contributing thus to the emergence of the concept of smart buildings (SBs), integrated in smart grids (SGs). The talk will also show the importance of an approach integrating "the human in the loop" for going toward the concept of the Internet of Energy. We will especially focus at the eco-district level with a multi-energy view (electric, thermal, ...)

Frederic Wurtz is Research Director at CNRS in G2ELab in Grenoble. His background is the design process of electromagnetic and electric devices and systems. He develops methods and tools in this area, especially optimisation, modeling and design tools. Those last years, he is developing new skills in the area of design of complete systems using electrical energy: typically cars, flights, smart-buildings and smart-grids integrated in the so called "Internet of Energy"

Thursday 18th of October

Simon Rouchier: Characterisation of building envelope properties by in-situ measurements and statistical learning

Since the first energy signature methods, several methods have been proposed for the characterisation of heat performance of envelopes from in-situ measurements in buildings. These methods specify an experimental procedure along with guidelines for data analysis. This seminar presents some recent advances in the applications of statistical learning to the characterisation of thermophysical properties.

Simon Rouchier is a researcher in the LOCIE lab, Université Savoie Mont-Blanc. After a Ph.D. thesis in heat and moisture transfer at the material scale, his research is now focused on the application of statistical learning and optimisation methods to building retrofitting.

Darren Robinson: Fit for purpose strategies and workflows for modelling stocks of buildings

There are myriad strategies for modelling stocks of buildings, ranging from statistical representations of the aggregate stock to the dynamic microsimulation of buildings in their urban contact that are occupied by people whose behaviours are stochastic. Choosing the appropriate strategy and developing or adapting a workflow to employ it for a particular geospatial context, is deceptively tricky. In this lecture I will: describe alternative stock modelling strategies and workflows for their execution; discuss the rationale that should be employed in selecting a strategy that is for for its purpose; discuss some of the more pertinent research questions that remain open.

Darren Robinson is Professor of Architectural and Urban Sciences and Director of Research in the School of Architecture at the University of Sheffield. He has many research interests, but he is mainly recognised for his expertise in the energy simulation of buildings in their urban context that are occupied by people whose behaviours are stochastic in nature. He has over 100 refereed scientific publications to his credit including the book "Computer modelling for sustainable urban design". He sits on the editorial advisory boards of the Building and Environment (BAE) Journal and the on-line journal Sustainability. A Fellow of IBPSA, he is a recipient of the CIBSE Napier-Shaw Medal, the Journal of Building Performance Simulation Best Paper Prize and the BAE Best Paper Award (twice).

Friday 19th of October

Jan Carmeliet: Multiphysics Modeling of Materials, Assemblies, Buildings and Cities

There is growing evidence that heat waves are becoming more frequent under increased greenhouse forcing, associated with higher daytime temperatures and reduced night-time cooling, which might exceed the limits of thermoregulation of the human body and affect dramatically human health. Especially urban areas are affected, since these regions in addition experience an urban heat island (UHI) effect characterized by higher air temperatures compared to the surrounding rural environment. A necessary breakthrough is a shift away from a fragmented approach towards an integrated multiscale urban climate analysis. This type of research is a rather new domain of research and might be based on an all-physics understanding and modeling of the urban climate ranging from the scales of material and buildings, to the scales of a group of several buildings, street canyons, neighbourhoods, cities and urban regions, referred to as multiscale building physics. To adequately cover global and local urban heat island effect, regional and mesoscale climate analyses have to be downscaled to sub-kilometer resolution and linked with urban climate models at neighborhood and street canyon scales. Such a multiscale urban climate model allows to analyze the influence of urban and building parameters on thermal comfort and the building cooling demand. The importance of accounting for the local urban climate when quantifying the space cooling demands of buildings in an urban

environment is demonstrated. The heat-moisture transport model for building materials allows the design of new building materials, which can help in the mitigation of local heat islands. With respect to evaporative cooling materials, we need to optimize their water retention and evaporative cooling by tailoring their pore structure. The understanding and information obtained from pore-scale investigations enables to understand macro-scale transport processes, and enabling us to explore the potential of new evaporative cooling materials at local urban scale.

Jan Carmeliet is full professor at the Chair of Building Physics at the department of Mechanical Engineering at ETH Zürich and head of the Laboratory of Multiscale studies in Building Physics of EMPA (until 01.04.2017), Dübendorf (Swiss Federal Laboratories for Materials Science and Technology), Switzerland. His research resulted until now in more than 245 scientific journal papers. His research interests concern multiscale behaviour of porous and granular materials and their fluid interactions, heat-air-moisture flow in the urban environment and multi-energy decentralized systems at building and urban scale. Research is based on advanced computational modelling (atomistic, molecular dynamics, discrete elements, lattice Boltzmann, CFD, FEM, energy-hub) and advanced experimental techniques (X-ray and Neutron Tomography, …) and time-resolved imaging in wind and water tunnels (PIV, LIF).