Ph.D. thesis: statistical modelling of coupled heat and air transfer in buildings

Keywords: building energy, ventilation, statistical learning

Duration: 3 years, starting in the fall of 2020

Motivation

The demand for air conditioning of buildings is bound to increase in the next decades, due to the combined effects of climate change and increasing comfort standards in all countries. The need to reduce the energy demand for cooling has led practitioners to reinstate and adapt traditional natural cooling practices, some of which have existed for centuries: ventilative cooling, cool roofs, green roofs, evaporative cooling, etc.

The main barrier to a successful generalisation of natural cooling is the difficulty to ensure its performance. Accurate predictions of air flow rates are a necessary condition for a reliable design, but are also very uncertain. Moreover, once a natural cooling solution has been implemented, there is no way of assessing its effectiveness on thermal comfort.

In order to address these challenges, we propose the development of data-driven modelling of coupled heat and air transfer in buildings, especially in warm weather conditions. The strategy of the project lays on using statistical learning methods for the characterisation and prediction of heat and air flow.

Expected work

The proposed Ph.D. thesis will have two main work packages:

- The application of statistical models for time series (dynamic Bayesian networks, hidden Markov models, auto-regressive models, regime-switching models…) to learning the coupled heat and air transfer in buildings, and detecting events that influence it: occupation, windows opening, etc.
- The monitoring of an experimental test house, in order to gather data for model training and validation.

Candidate

Required: Master’s degree, engineering degree or equivalent.

Examples of suitable candidates are:

- Candidates with a degree in applied mathematics, physics or statistics, who wish to apply their background to energy conservation applications
- Candidates with a degree in building energy, fluid mechanics or thermodynamics, with a background in programming and modelling

Apply by sending CV and cover letter to: simon.rouchier@univ-smb.fr

Context of the project

This proposal is part of the MODERNAT project (data-driven modelling of heat and air transfer in buildings for the estimation of their natural cooling potential), funded by the Auvergne Rhône-Alpes region. Participants of the project are the LOCIE and CEA LITEN laboratories, and the Albedo Energie engineering office.

Links

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