How I learned to stop worrying and love uncertainty

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# Abstract

Building performance simulation is a powerful and exact tool to estimate the thermo-physical properties and behaviour of a building and its systems. Given the exact nature of the calculations, however, it is important to properly specify the inputs to get reasonable answers. That is, given that uncertainty in inputs impacts the accuracy of, and confidence in, outputs, a user must work to both reduce uncertainty where possible and properly quantify impacts when the uncertainty is irreducible. For the simulator this often means making ‘reasonable guesses’ or defaulting to reasonable values for unknown inputs. In this workshop, we will discuss approaches to specifying these inputs through an intuitive interpretation of probability distributions, as well as methods to use these distributions to analyse the impact of this uncertainty on estimates of building performance. We will do this through a discussion about the sources of uncertainty in simulation, specifying prior probabilities (rigorous guessing), using simulators and regression models, and examining outputs with a view to quantifying error with the excitingly-named Monte Carlo method. The discussion will be accompanied by practical exercises. At the end of the introduction on the first day, the students will be assigned small projects in groups of two. These projects will each examine the influence of an input, or a family of inputs, on the energy performance of a building. The projects will be evaluated at the end of day two.

# Agenda

Saturday, 05 January 2019

10:00 – 13:00 🡪 Introduction and qualitative discussion of uncertainty, forming teams, setup, the briefest of introductions to Python

14:00 – 17:00 🡪 Introduction to regression and data-based methods, worked examples of uncertainty and sensitivity analysis using regression models, projects assigned

Sunday, 06 January 2019

10:00 – 13:00 🡪 Group project work, instructors available for discussions

14:00 – 16:30 🡪 Group project presentation and critique

# Preparation

Please download the latest version of [python](https://www.python.org/downloads/). Follow the instructions in [this wiki](https://github.com/paragrastogi/CEPT_Workshop_January2019/wiki) to simplify your life. If you don’t know what a probability distribution is, [look it up](https://en.wikipedia.org/wiki/Probability_distribution).