bridging the gaps

Sustainable Urban Spaces

MSc Competition 2008

UCL

Uncertainty in building performance simulations

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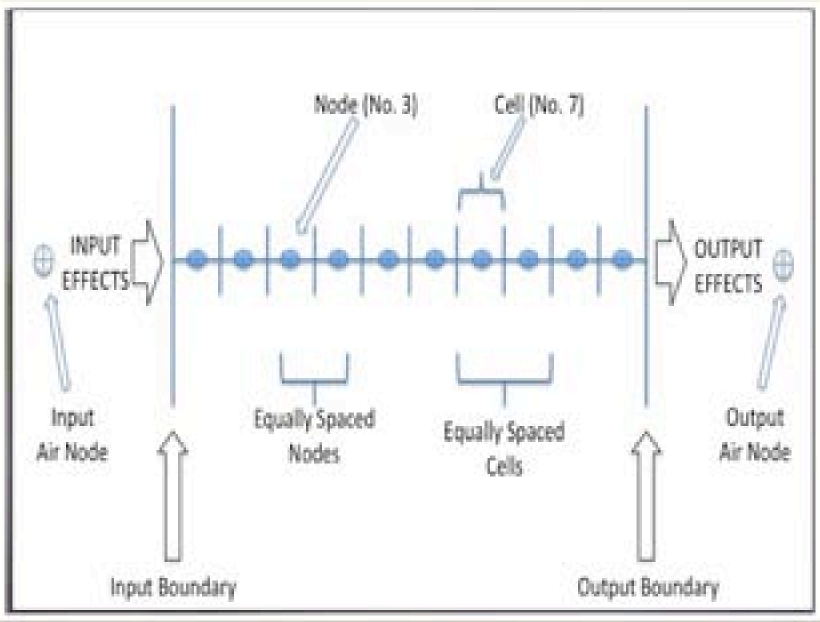
Motivation

Today uncertainty pervades most building simulation models, which results in predicted values of energy usage not meeting with those which are later collected through measurements. It would be extremely helpful to understand better the effect of uncertainty on the performance of these models. We intend to take on this challenge by profiling a test-bed case with the use of different approaches to assess the uncertainties related to quantities such as the properties of building materials (thermal conductivity, density and specific heat capacity).

Concept Building Framework



Preliminary System of Interest

One-Dimension Test-bed

By scaling down our system of interest to an initial 1-Dimensional framework we intend to statistically assess the error which is present within a 1-D setting of an input, output and intervening material system. Using common steady state equations:

$$\frac{d}{dx}\left(\lambda \frac{dT}{dx}\right) = 0 \qquad \frac{dT}{dt} = \frac{\lambda}{\rho c}\left(\frac{d^2T}{dx^2}\right)$$

We intend to replicate this physical framework and apply three different methods to assess the uncertainties present in a probabilistic way.

Intended Approaches

<u>Monte Carlo Analysis Approach:</u>

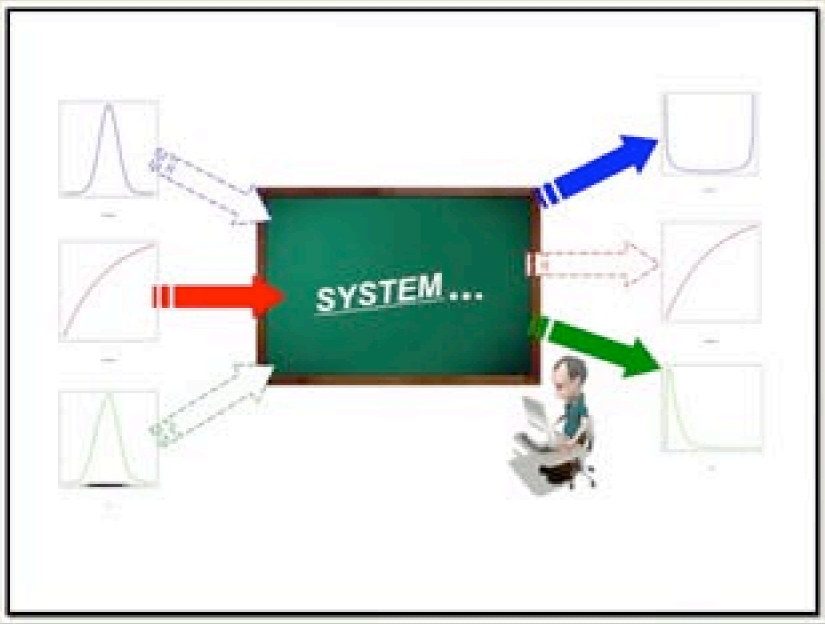
Run the model multiple times, with different properties sampled randomly from uncertainty distributions.

<u>Monte Carlo Analysis with Experimental Design:</u>

A more advanced sampling approach will reduce the number of runs required.

<u>Error Propagation Approach:</u>

A single run simulation of the system will propagate the input uncertainties through the system and (hopefully) provide a faster assessment of the output uncertainty.



Uncertainty in, Uncertainty out