Thermal Performance Characterization using Time Series Data - IEA EBC Annex 58 Guidelines - DTU Orbit (08/11/2017)

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This document presents guidelines for using time series analysis methods, models and tools for estimating the thermal performance of buildings and building components. The thermal performance is measured as estimated parameters of a model, or parameters derived from estimated parameters of a model. A special focus will be on estimating the Heat Loss Coefficient (HLC) and gA-value. Provided in the guidelines are modelling procedures with which consistent results for estimation of energy performance of buildings and building components can be achieved.

These guidelines start with simple (non-dynamical) steady state models where the parameters are found using classical methods for linear regression. Such steady state techniques provide sub-optimal use of the information embedded in the data and provides information only about the HLC and gA-values.

Next the guidelines consider dynamical models. Firstly, linear input-output models are considered. More specifically we will consider the class of AutoRegressive with eXogenous input (ARX) (p) models. These models provides information about the HLC and gA-values, and information about the dynamics (most frequently described as time-constants for the system).

Finally, grey-box models are considered. This class of models is formulated as state space models which are able to provide rather detailed information about the internal physical parameters of a construction. This class of models bridges the gap between physical and statistical modelling. A grey-box model is formulated as a continuous time model for the states of the system, together with a discrete set of equations describing how the measurements are linked to the states. The frequently used so-called RC-network models belongs to the class of linear greybox models. However, advanced constructions, like a wall with PV-integration or a complex building with a lot of glass, often calls for a description of nonlinear phenomena. This can be facilitated by the class of non-linear grey-box models.

It is assumed that data is available as time series of measurements. Hence it should be noticed that the important steps of experimental design and setting up the experiment have been conducted.

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