Grey-Box Building Models
for Model Order Reduction and Control

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Grey-Box modelling is considered as a strong framework for the creation of low-order models for analysis and control of monitored buildings. This paper presents an approach to obtain useful grey-box models in a largely automated way.

The first step is the creation of a building library with many potential model candidates. The Modelica package *FastBuildings* contains low-order models for thermal zones, HVAC, users, single and multi-zone buildings.

Next, a toolbox is presented that largely automates the parameter estimation of the *FastBuildings* models. It is implemented as a Python module that wraps the functionality of *JModelica.org* and presents the user a high-level interface for all common operations like data handling, model selection, parameter estimation and validation. A high-level overview of the toolbox is shown in Figure 1.
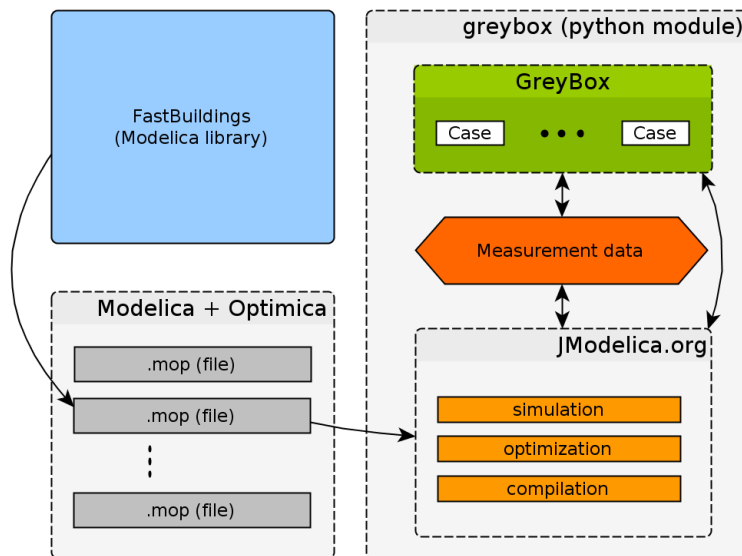

Figure 1: Overview of the grey-box buildings toolbox

The use of a gradient-based method allows an efficient numerical solution of the estimation problems. Specific attention is paid to robustness and ease-of-use. A Latin hypercube sampling of the parameter search space overcomes issues related to the non-convexity of the optimization problem.

The toolbox is applied to a model order reduction case study for a single-family dwelling. The selected model has 11 parameters and is able to predict the indoor temperature in an open-loop simulation (with a priori knowledge about weather and electricity consumption) with an RMSE of 0.16 K.