Parameters Identification for Thermal Building Models by a Goal-oriented Inverse Method

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ABSTRACT

To carry out a representative energy performance diagnosis of an existing building, one must have a good knowledge of the thermal properties of its systems and envelope. Unfortunately, these pieces of information are generally not available. The present paper introduces an inverse strategy for thermal models parameters identification, namely the goal-oriented inverse method [1]. This original technique aims at identifying only the set of parameters that affects the prediction of a quantity of interest.

To asses the performance of the goal-oriented method in thermal model parameters identification, the technique has been implemented on a simplified mono-zone building thermal model. As a first step, the steady state problem was treated and the parameters to be identified were the global thermal conductivity of the envelope and its outside convective heat exchange coefficient. Then, the dynamic state was considered and the global heat capacity of the envelope was sought in addition to the previous parameters.

In both states, the robustness of the inverse method has been tested on different levels of instrumentation noise and on different configurations of available sensors data. The parameters identification results were compared to those obtained with more common inverse methods, i.e Tikhonov regularization technique [3] and the constitutive relation error approach [2].

The first results show a higher accuracy of the goal-oriented inverse method in the prediction of the quantity of interest and in the identification of the model parameters involved in its computation. This performance is achieved with a reduced amount of instrumentation data and in a reduced computation time. We also observe that the goal-oriented strategy is less sensitive to the instrumentation noise than the classical inverse methods.

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