A posteriori estimation of modelling error for a building thermal model

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Xiaodong LI*, Alexandre Nassiopoulos†, Julien Waeytens* and Rachida Chakir*

* Université Paris-Est, IFSTTAR
14-20 Boulevard Newton
F-77447 Marne la Vallée, France
e-mail: {xiaodong.li ; julien.waeytens ; rachida.chakir}@ifsttar.fr

† LUNAM Université, IFSTTAR
Route de Bouaye
F-44344 Bouguenais, France
e-mail: alexandre.nassiopoulos@ifsttar.fr

ABSTRACT

In the past decade, efficient energy use for civil buildings receives big attention, especially through optimal control which is meant to minimize energy consumption and maintain occupant comfort. Different thermal models can be considered in both theoretical and practical use. In our case we focus on a building model in which thermal dynamics of envelopes and zones are described respectively by a parabolic PDE coupled with an ODE (cf. [4]).

For various technical and numerical reasons, model simplification is necessary in practice. In this case, modeling errors should also be taken into account. In our paper, we investigate the impact of the modeling error on some quantity of interest such as the average temperature.

More precisely, we are interested in estimating quantitatively the bounds of the error on the quantities of interest due to model simplification through *a posteriori* error estimators which could be later used to choose the appropriate simplified model for optimal control purpose.

In this paper, we apply and extend the adaptive modeling strategy of elliptic PDEs (cf. [5], [6]) to a building thermal model: parameter homogenization for a single PDE system. For the steady case, the upper and lower bounds between the fine and simplified models are obtained through a dual approach as in the literature. We use the solutions of primal and dual problems associated to the simplified model and the parameters are assumed to be known. For the unsteady case the upper bound is obtained using similar technique.

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