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ROBUST PREDICTION OF A QUANTITY OF INTEREST IN BUILDING THERMAL PROBLEMS USING A GOAL-ORIENTED INVERSE METHOD

Z. Djatouti[1*], J. Waeytens[1], L. Chamoin[2] and P. Chatellier[1]

[1] Université Paris-Est, IFSTTAR, 14-20 Boulevard Newton, F-77447 Marne la Vallée Cedex 2.
[2] ENS Paris-Saclay, 61 avenue du prsident Wilson, F-94230 Cachan, France.

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In the global context of environmental challenges where reducing the existing buildings energy consumption is of major concern, a goal-oriented inverse method may be used to compensate the lack of effective tools for the evaluation of the existing buildings energy performance.
Unlike standard inverse methods that aim at identifying all the model parameters in order to rebuild its entire solution, the goal-oriented inverse method introduced in [1] focuses on a reliable prediction of a quantity of interest by updating the appropriate model parameters. As only few model parameters are updated, the goal-oriented inverse method may require less amount of sensor outputs and computation time than standard inverse methods.
The robustness of the goal oriented inverse method is first assessed on a heat transfer problem at the envelop scale. The method is studied for different configurations of available sensor data and three measurement noise levels. The results are compared to those obtained with the Tikhonov regularization method [2] and the constitutive relation error method [3].
The results show that in the steady state case, the goal-oriented inverse method predicts the quantity of interest and identifies the parameters involved in its computation with a higher accuracy and using less sensors data compared to the standard methods. Furthermore, the goal-oriented inverse method appears to be less sensitive to the measurement noise. In the transient case, the resolution of the goal-oriented inverse problem implies several resolutions of coupled forward-backward thermal problems increasing the computation time. To overcome this hurdle, work is in progress to combine the goal oriented inverse method and the Proper Generalized Decomposition (PGD) model reduction method [4] in view of real building applications.

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