Goal-oriented strategy for the updating of mechanical models

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method, i.e. taking the sensitivity of parameters with respect to the quantity of interest into account. In order to define such a tool, several works can be found in the litterature [7, 8, 9, 10]. Most of them are based on the dual-weighted residual technique and derive estimates on the error made on the quantity of interest, this error being a consequence of the various sources of error (discretization, identification...). The specific goal here is to derive a strategy enabling one to get a certified and accurate prediction of the quantity of interest while maintaining a reasonable computational effort for the whole process (calibration and prediction).

The proposed approach is based on a FE model with parameters calibrated using the CRE; it also uses the CRE and the associated adjoint-based error estimate to control and certify the predicted quantity of interest, coming back to the calibration step and refining the estimation of model parameters only when the required accuracy is not reached. The strategy is therefore a fully goal-oriented and adaptive procedure, in which model updating is iteratively driven by the quality of the output prediction. We illustrate the performances of the method on several numerical experiments dealing with mechanical structures.

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[7]. On the one hand, we define new dedicated cost functions that lead to a convenient goal-oriented updating process, selecting automatically the relevant model parameters that need to be updated for the prediction of the quantity of interest. This leads to a partial model calibration that enables to obtain an approximate value of the quantity of interest with sufficient accuracy and minimal model identification effort. The updating method uses the constitutive relation error framework as well as duality and adjoint techniques.On the other hand, we define quantitative sensitivity tools that enable to set up optimal experiments and measurements (sensor location, type of measure) with respect to the output of interest to predict. We present the new method and associated tools and performances in the framework of linear elasticity as well as time-dependent models (an example is given in Fig. 1).
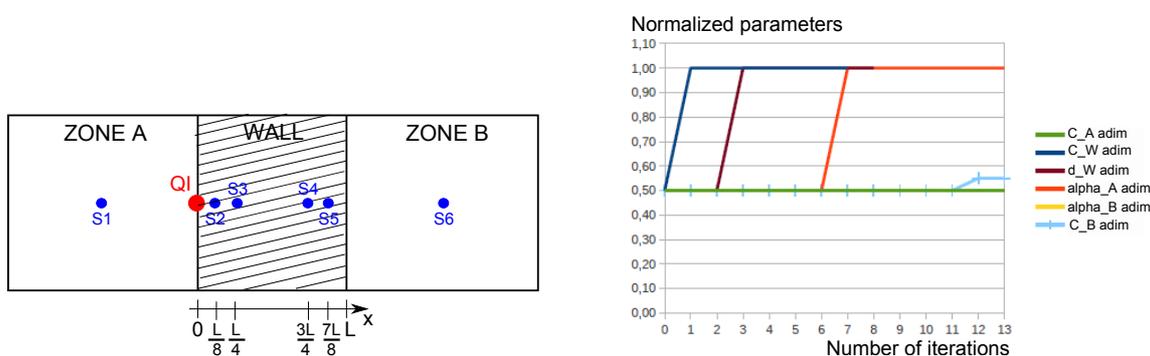

Figure 1: Unsteady thermal problem with two zones separated with a wall (left), and updated parameter values with the goal-oriented calibration technique (right)

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