MODEL ERRORS IN COMPUTATIONAL MESO-MACRO-SCALE CONSTITUTIVE MODELING

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In constitutive modeling, a key issue is to choose the complexity of a model such that model and discretization errors are properly balanced. In other words, there is no point in choosing a complex, and computationally demanding, constitutive model if the solution of the structural problem has low quality. In this contribution, we present a strategy for adapting the model with respect to the total accuracy of the computation. The generated (model)error is estimated using the technique of solving a dual problem and is compared to a preset tolerance. Similarly as for discretization errors, this leads to the choice of goal-oriented error estimators that measure the quality of desired output quantities.

In particular, we focus on problems in Computational Multiscale Modeling (CMM), where the coupling between different geometrical scales is taken into account. Instead of a priori homogenization techniques, the macro-scale model is defined thru the homogenized response of a small-scale problem. In practice, the constitutive model is replaced by a "small-scale" finite element problem, solved for each (Gauss)point in the domain. The high cost of this strategy clearly motivates the use of adaptive techniques. The small-scale effects that cannot be homogenized a priori, usually occur only in certain parts of the domain. Such parts of the domain are, for instance, areas of high stresses or areas of high influence on the chosen output quantity.