

A universe of models and data -- multilevel methods, multifidelity methods and beyond

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Due to the advancing possibilities of modeling, computing technology and data acquisition, today a variety of simulation models and data is available that is nearly unmanageable. This diversity in turn opens up new possibilities for the development of computational methods in which information from different sources and of different quality is merged in order to further increase the efficiency of computational procedures. This is particularly important for outer-loop applications, which not only require a large number of model evaluations, but also a careful consideration of the mutual influences between model creation and refinement on the one hand and the quality of the outer-loop result on the other.

The lecture presents important model classes, points out possibilities for structuring the model and data universe and gives an overview of multilevel and multifidelity information fusion methods for a selected outer-loop application, namely the computation of the failure probability in the context of reliability assessment. Furthermore, the potential of machine learning to automate the use of models and to further increase the computational efficiency is highlighted.