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Fast and Memory Efficient Two-Scale Simulations of Components by Combining Reduced Order Models and Composite Voxel on the Micro-Scale

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For the simulation of industrial components made of composite materials, reduced order models are commonly applied. These methods can be split into an offline and online phase. In the offline phase an effective material law for the macro-scale is derived by micro-scale simulations. In the online phase only ordinary differential equations for the reduced variables need to be solved to obtain the stress response of the composite material at each integration point of the component simulation.

Since the microstructure is different at each integration point the necessary precalculations in the offline phase depend linearly on the number elements in the mesh of the component. If plastic effects are to be taken into account for the component simulation, the computational effort for the online phase of the pRBMOR method of Fritzen and Leuschner [1] also scales cubically with the resolution of the micro-scale.

In this talk we will discuss the combination of the composite voxel technique of Kabel et al. [2] with the NTFA-TSO of Michel and Suquet [3] as well as the pRBMOR of Fritzen and Leuschner [1] to accelerate two-scale simulations of components with elasto-viscoplastic deformations.

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