University of Stuttgart
Germany

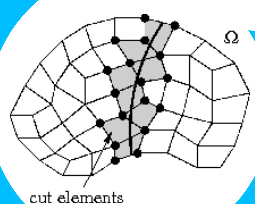
Computational homogenization with XFEM

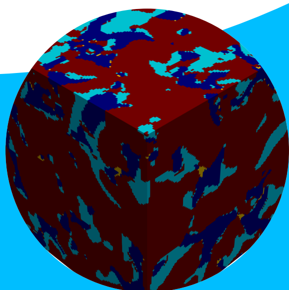
Numerical analyses of composite materials are intrinsically a multiscale endeavor. The use of concurrent multiscale simulations has become the gold standard for high-fidelity multiscale analysis. Key to this approach is an algorithmically efficient and accurate solver at the microscale. A finite element based highly efficient solver using the fast Fourier transform will be used to solve the microscale problem: Fourier accelerated nodal solvers (FANS). Resolving the material intefaces in the microstructure exactly is vital for the accuracy of the solver. FANS will be used in tandem with the extended finite element method (XFEM) which enables a local enrichment of approximation spaces using the partition of unity concept. In solids, XFEM provides substantial advantages by enabling optimal convergence rates for such applications at a cost although stresses and strains are (partially) discontinuous at the interface.

In this project, we combine **Fourier accelerated nodal solvers (FANS)** for computational homogenization and the **Extended finite element method (XFEM)** locally to resolve material interfaces efficiently. Numerical experiments of periodic homogenization for multi-physics problems will be carried out on multi-phase image based microstructures to illustrate accuracy, viability and efficiency of the approach.

- Computational homogenization
- Fourier accelerated nodal solvers
- Extended finite element method

Matlab
C/C++





Sanath Keshav • **keshav@mechbau.uni-stuttgart.de**