Dual-weighted residual goal-oriented error estimation for space-time adaptivity in phase-field fracture

Viktor Kosin[1] Amélie Fau[2] François Hild[3] Thomas Wick[4]

This presentation focuses on space-time adaptivity for phase-field fracture problems. The methodology requires a space-time formulation and utilizes a space-time Galerkin finite element discretization for the governing phase-field equations. Then, goal functionals (i.e., quantities of interest) are introduced. The computational implementation of goal-oriented error control employs the dual-weighted residual method in which an adjoint problem must be solved. As the analysis is quasi-static, without a temporal derivative, the adjoint problem of the quasi-static primal problem decouples in time. Nonetheless, time-averaged goal functionals can also be considered. The temporal and spatial errors are localized using a partition of unity, which allows one to adaptively refine and coarsen the time intervals and space elements in the space-time cylinder. Numerical tests are performed on a single edge notched tensile and shear test to investigate the quality of the proposed error estimator.

[1]Université Paris-Saclay, ÉNS Paris-Saclay, LMPS / Leibniz University Hannover, IfAM
viktor.kosin@ens-paris-saclay.fr

[2]Université Paris-Saclay, ÉNS Paris-Saclay, LMPS
amelie.fau@ens-paris-saclay.fr

[3]Université Paris-Saclay, ÉNS Paris-Saclay, LMPS
francois.hild@ens-paris-saclay.fr

[4]Leibniz University Hannover, IfAM
thomas.wick@ifam.uni-hannover.de