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**Algebraic Multi-Grid techniques for the eXtended Finite  
Element Method**

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After more than a decade of research on the eXtended Finite Element Method (XFEM), the method has developed into a valuable tool for simulating crack propagation, fluid-structure interaction and multiphase/multimaterial problems. As problem sizes grow, the wish to apply iterative Algebraic Multi-Grid (AMG) methods to XFEM problem arises. However, the introduction of additional degrees of freedom with special approximation functions, which is the main ingredient of XFEM, poses a number of challenges that hamper the straight forward application of AMG. Examples of such difficulties are increased condition numbers of the system matrix, varying number of unknowns per node, and matrix graphs, that do not reflect physical properties of the system.

This presentation will illustrate the main difficulties of using AMG methods for XFEM and will propose a number of strategies that eventually allow one to reach the performance that one expects from using AMG for standard Finite Element Methods.