Algebraic multigrid for finite element discretizations

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Algebraic multigrid (AMG) methods are known as efficient to solve linear systems resulting from low order finite element (FE) approximations of elliptic PDEs. However, just going to moderate order (say, P3, P4) may raise difficulties. On the other hand, non elliptic problems cannot be tackled directly by AMG methods.

In this lecture, we show how these difficulties may be met using aggregation-based AMG, considering moderate order FE on the one hand, and Stokes problems on the other hand. In both cases, the key is to combine theoretical analysis that guaranties to be "on the safe side" with efficient coding (including many heuristics) that allow one to obtain robust results on real life applications.

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