Additive Schur complement approximation and application to multilevel preconditioning

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Sparse Schur complement approximations play a key role in various iterative methods for solving systems of linear algebraic equations arising from finite element discretization of partial differential equations. In this talk we consider an algorithm for additive Schur complement approximation that is based on computing and assembling exact Schur complements of local (stiffness) matrices associated with a covering of the entire domain by overlapping subdomains. The resulting approximation is spectrally equivalent to the global Schur complement with a bound on the relative condition number independent of the variations in the coefficients of the model elliptic equation. This allows for the construction of an algebraic multilevel iteration method of optimal computational complexity for solving problems with highly oscillatory coefficients.