Energy Minimizing Coarse Spaces with Functional Constraints

Ludmil Zikatanov
Department of Mathematics, Penn State University, USA

We will report on the construction of energy minimizing coarse spaces built by patching solutions to appropriate saddle point problems. We first set an abstract framework for such constructions, and then we give an example of constructing coarse space and stable interpolation operator for the two level Schwarz method. We apply the theoretical results in the design of coarse spaces for discretizations of PDE with large varying coefficients. The stability and approximation bounds of the constructed interpolant are in a weighted norm and are independent of the variations in the coefficients. Such spaces can be used in for numerical upscaling and for two level overlapping Schwarz algorithms for elliptic PDEs with large coefficient jumps generally not resolved by a standard coarse grid. This is a joint work with Robert Scheichl (University of Bath, UK) and Panayot S. Vassilevski (Lawrence Livermore National Lab).