Coarse Spaces By Energy Minimization And Integral Constraints

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We describe a general framework for constructing operator-dependent coarse spaces that can either be used in AMG (algebraic multigrid) or as upscaling (discretization) tool. The approach utilizes minimization of the energy functionals associated with the PDE of interest. The local basis functions are constructed by minimizing the underlined functional subject to a set of integral constraints. The constraints are chosen so that the resulting space spans (as accurately as needed) any a priori given set of functions (vectors). We illustrate the AMG convergence as well as the upscaling properties of the coarse spaces with some preliminary numerical examples.