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Coarse Spaces by Constrained Energy Minimization

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We consider an unified approach of constructing operator-dependent discretization spaces on relatively coarse computationally feasible meshes. The approach utilizes natural energy functionals associated with the PDEs of interest. We construct local basis functions by minimizing the underlined functional subject to a set of constraints. The constraints are chosen so that the resulting spaces possess increasingly high order of approximation. We investigate the proposed approach from an upscaling discretization point of view which we illustrate with some preliminary numerical examples.