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Multilevel adaptive sampling for inverse problems

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Over the past few decades, efficient and robust multilevel solvers have been developed for a variety of applications which range from medical tomography to flow in porous media. Recent success of these multilevel solvers is due to the development of general multiscale concepts such as operator-induced variational coarsening. This approach implicitly treats the multiscale aspects of the fine-scale model in its generation of successively coarser representations.

Clearly such solvers can be used as a "black box" (within an MCMC scheme, for example) for inferring unknown parameters or initial conditions in inverse problems. While computational efficiency has been the primary motivation for the development of such multilevel solvers, it is hard to resist the temptation of prying into these solvers so that the coarser representations can be used to help guide the posterior sampling. In this talk we explore sequential and Markov chain Monte Carlo methods for exploiting the implicit coarsened representations within a mulitlevel solver to speed up posterior sampling.