Greedy approximation of a solution manifold

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Many design or optimization tasks in scientific computation require a frequent(even online) evaluation of solutions to parameter dependent families of partial differential equations describing the underlying model. This is often only feasible when the model is suitably reduced. The so called Reduced Basis Method is a model reduction paradigm that has recently been attracting considerable attention since it aims at certifying the quality of the reduced model through a-posteriori error bounds. The central idea is to approximate the solution manifold, comprised of all solutions obtained when the parameters range over the given parameter domain by the linear hull of possibly few snapshots from that manifold so as to still guarantee that the maximal error stays below a given target tolerance. Each parameter query, e.g. in an optimization process, requires then only solving a relatively small problem in the reduced space. This can be viewed as finding a problem dependent dictionary with respect to which all solutions are nearly sparse. This talk highlights the basic ideas behind this method. In particular, it is indicated under which circumstances certain greedy strategies for finding the generating snapshots are optimal in the sense that the corresponding subspaces realize the rate of the Kolmogorov n-widths even for problem classes not covered by conventional strategies.