Model Reduction in PDE-Constrained Optimization

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The numerical solution of optimization problems governed by partial differential equations (PDEs) requires the repeated solution of coupled systems of PDEs. Model reduction can be used to substantially lower the computational cost at various stages of the optimization algorithm, for example, to construct Hessian approximations for use within a traditional gradient based optimization algorithms, or to generate surrogate models for use within a trust-region method. I will review recent approaches and their convergence properties, and demonstrate their performance on example problems. The emphasis is on nonlinear PDE constrained optimization problems, where precomputations of reduced order models that are valid over the entire optimization parameter range are typically impossible.