57e Model Reduction Based Optimization for Distributed Parameter Systems

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A model reduction-based optimization framework is presented, to be used with input/output dynamic simulators in order to perform both steady state and dynamic optimisation. This is the case when a black-box code (e.g. a commercial package) is used to model a process, and the system Jacobians and Hessians cannot be directly computed. Therefore, it is in general, computationally inefficient to perform gradient-based optimization and parameter estimation using such codes.

For steady state optimization a two-step projection approach is presented [1]: In the first projection, the state variables are projected to the low-dimensional subspace of the dominant eigenmodes identified adaptively by the Recursive Projection Method (RPM)[2]. The second projection is performed onto the subspace of the few decision variables without the need to compute any large-scale matrices. Furthermore, a methodology is discussed that is used to perform stable, efficient dynamic optimization/optimal control by discretizing the time domain in a number of subintervals and performing reduced Hessian SQP-type optimization to the resulting problem [3]. We again adopt a two-step projection strategy exploiting a Newton-Picard based scheme that is used for the stabilization of multiple shooting procedures [4]. We use illustrative distributed parameter systems including the tubular reactor and large-scale CFD codes to demonstrate our optimization methodologies.

References

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