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Waveform relaxation methods for thermal fluid structure interaction

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We consider unsteady thermal interaction between two bodies. Our goal is a method that is partitioned, fast, allows for adaptive and different time steps on both sides, and is possibly parallel. As has been shown, waveform relaxation methods are prime candidates for this. These contain a relaxation parameter, the choice of which is crucial for practical performance.

We present two strategies: Use a black box strategy through the use of Quasi-Newton-Interface methods [3] leading to fast linear convergence, or optimal relaxation parameters, leading to possibly superlinear convergence. The latter requires a choice of problem, coupling method and discretizations. For the case of a Dirichlet-Neumann coupling of two linear heat equations, optimal relaxation parameters are available [2]. We show comparisons of these approaches for a variety of materials.

Additionally, we consider the use of one sided asynchronous communication in MPI to allow for parallelism in the sequential Dirichlet-Iteration [1].

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