Convergence Analysis for Parareal and Multigrid-reduction-in-time

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Hardware trends and scaling limits have driven the development of algorithms that allow space-time parallelism. These methods consider the solution of time-dependent systems of partial differential equations (PDEs), and allow simultaneous solution across multiple time steps, in contrast to classical time-stepping approaches considering the sequential solution of one time step after the other. While this is not a new idea, the interest in developing new space-time and time-parallel approaches for a variety of PDEs has grown in recent years. With such intense effort in the development of new schemes and with the observation that convergence of these methods is poor for hyperbolic problems relative to parabolic-type PDEs, there is a pressing need for complementary analysis tools, to provide understanding of the relative performance and to inform the optimization of algorithmic parameters as schemes are adapted to new problems. In this talk, we compare and contrast analysis schemes for parallel-in-time algorithms of the Parareal and multigrid-reduction-in-time (MGRIT) methodologies.

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