

Good Parallel in Time Methods for Hyperbolic Problems

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Parallel in Time (PinT) methods have received a lot of attention over the past years, and there is an annual conference now dedicated to these techniques. Parallelizing a large scale computation in the time direction appears to be rather unusual at first sight, since time dependent problems obey a causality principle: the solution later in time is depending on the solution earlier in time, and never the other way round, so there does not seem to be any natural parallelism. Nevertheless, when parallelization in space for such problems saturates, parallelization in time appears tempting.

I will first show in my talk why for parabolic problems, parallelization in time is rather natural. This explains why there are in the meantime many successful PinT algorithms for such problems, like Parareal, Parareal-Schwarz-Waveform-Relaxation and Space-Time-Multigrid. In contrast, for hyperbolic problems, parallelization in time is much more challenging. This is because solutions of hyperbolic problems depend on their history in a much more stringent and detailed way than for parabolic problems that forget details over time. Nevertheless, several successful PinT algorithms have been developed for hyperbolic problems over the past decade, and I will explain three of them in my lecture: ParaExp, ParaDiag, and (Un)mapped Tent Pitching.

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