Time parallel methods: Is it possible to predict the far future, before the near future is know accurately ?

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Resumen

Time dependent problems are often solved using time marching schemes, which means that the solution is sequentially computed time step after time step. Such schemes can remain effective on parallel computers, as long as each time step is costly enough. If not, parallelism in time could alleviate the situation, but is it possible to do useful computations in the far future before the near future results are known ?

I first present a historical overview of algorithms that were proposed over the last 40 years to obtain a certain amount of time parallelism. I will then introduce a general time domain decomposition method based on multiple shooting, which permits the parallel in time computation of solutions of time dependent problems. This time domain decomposition method contains more recent time parallel algorithms like the parareal algorithm. A convergence analysis reveals superlinear convergence of the method on bounded time intervals, and linear convergence on unbounded time intervals under certain conditions. I will illustrate the results with numerical experiments.