A micro/macro parareal algorithm for a class of multiscale-in-time systems

Frederic Legoll (Ecole des Ponts ParisTech), T. Lelievre, G. Samaey

We introduce and analyze a micro/macro parareal algorithm for the time-parallel integration of singularly perturbed ordinary differential equations. The system we consider includes some fast and some slow variables, the limiting dynamics of which (in the limit of infinite time scale separation) is known.
The algorithm first computes a cheap but inaccurate macroscopic solution using a coarse propagator (by only evolving the slow variables according to their limiting dynamics). This solution is iteratively corrected by using a fine-scale propagator (simulating the full microscopic dynamics on both slow and fast variables), in the parareal algorithm spirit.
The efficiency of the approach is demonstrated on the basis of numerical analysis arguments and representative numerical experiments.
Joint work with T. Lelievre and G. Samaey.