

New approaches to space-time splitting with higher accuracy

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Classic time splitting schemes for PDE's apply operators or dimensions separately, often in the hope of using simpler implicit solvers and allowing larger time steps. However, it is known that splitting suffers order reduction with stiff problems, as well as difficulties achieving higher-order in time, which can require negative or large time steps outside the interval. We present results from known implicit splitting techniques, but combined with deferred corrections to achieve higher-order in time. This exposes some additional parallelism and can use fast GPU solvers. We then combine the approach with higher-order spatial discretizations, resulting in significantly reduced space-time errors. Demonstrations on several model problems show improved dispersive errors while still allowing larger time steps, simpler solvers, and large ratios of material properties or grid spacing.