Scaling of PDE Solvers at Exascale

Petascale Algorithms for Transport Simulatioin

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Abstract

Exascale computing platforms are targeting a thousand-fold performance gain over today's leading-edge supercomputers. To achieve these goals, these future architectures will feature billion-way concurrency with significantly less memory per core than currently available.

We examine performance of PDE-based simulations on the recent leadership-class computing systems and identify potential bottlenecks for future architecture-algorithm couplings and mitigation strategies that might be effected in through a co-design process. We also identify which problems and, particularly, which problem sizes will be amenable to exascale computing.

We present scaling results for ideal and less-than-ideal runtime conditions as well as measured performance on hundreds of thousands of cores for production spectral element codes used for computational electromagnetics and computational fluid dynamics.