

Lattice Boltzmann Hybrid Auto-Tuning on High-End Computational Platforms

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In this work we examine a hybrid threading/MPI tuning scheme that challenges the propositions that flat MPI implementations deliver superior performance, and that only exploiting local auto-tuning is sufficient to achieve globally-optimal performance. Our work, which examines that optimization of lattice Boltzmann magnetohydrodynamics (LBMHD) simulation, shows that neither of these assumptions holds. Although single-thread optimizations do provide the bulk of the potential performance advantages for moderately large problems, significant performance enhancements can be attained through tuning both the MPI process domain decomposition and the balance between threads and processes on multicore architectures. Moreover, we achieve these performance gains using a low overhead auto-tuning search scheme. Overall, our work points to approaches for improving intra- and inter-node efficiency on large-scale multicore systems for demanding scientific applications.