

HIGH-PERFORMANCE COMPUTING FOR COMPUTATIONAL FLUID DYNAMICS: LARGE-SCALE APPLICATIONS, VISUALIZATION, IN-SITU PROCESSING, AND PERFORMANCE PORTABILITY

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ABSTRACT

High-performance computing (HPC) plays a central role in advancing large-scale simulations in engineering and science, including computational fluid dynamics (CFD) and related applications. With the advent of GPU-accelerated supercomputers, simulations have reached unprecedented scales, introducing new challenges in computation, data management, and system utilization, as well as increasing demands on the efficient use of heterogeneous resources.

Among these challenges, efficient data handling and analysis have become critical bottlenecks. In-situ visualization and data processing techniques are increasingly important for reducing I/O costs and enabling efficient analysis of simulation results, particularly for large-scale CFD applications where data volumes are extreme. In addition, performance portability across heterogeneous architectures, such as GPUs and many-core processors, is essential for sustaining application performance on evolving computing platforms and ensuring long-term usability of scientific software.

This mini-symposium focuses on recent advances in HPC on modern supercomputers, with particular emphasis on large-scale applications, GPU acceleration, visualization, in-situ processing, and performance portability. We aim to bring together researchers working across simulation, algorithms, and system software, as well as real-world applications, to discuss current challenges and future directions in large-scale CFD applications, including emerging workflows that integrate computation and data analysis.