Engineering the Future: Advancements in Industrial Aerodynamic Simulations

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Key words: FVM/FE, SEM/FR/DG, LES, AMR, aeronautical applications, GPUs, extreme scaling.

ABSTRACT

The aviation sector presently accounts for over 2% of global greenhouse gas (GHG) emissions, and this contribution is steadily rising. Without additional interventions, carbon dioxide (CO2) emissions from international aviation could surge nearly fourfold by 2050 compared to 2010. It is a collective responsibility of the scientific community and the aeronautical industry to pioneer novel, more efficient designs. In the pursuit of enhanced efficiency and environmental responsibility, numerical simulation techniques, such as Computational Fluid Dynamics (CFD), are emerging as pivotal tools in aeronautical design. These tools will be the linchpin differentiating success from failure. Nevertheless, despite the current integration of CFD in the design process, there exists a pressing need to elevate the capabilities of existing numerical simulation tools tailored for aeronautical design. This entails a transformative shift toward re-engineering these tools to harness the power of extreme-scale parallel computing platforms. This strategic transition will empower the aerospace industry to leverage High-Performance Computing (HPC) within the design loop, a crucial step toward achieving the performance and environmental objectives outlined in the European Union's ambitious targets.

The present mini symposium will be focused on the efforts to address this challenge. The topics of interest are related to improving the convergence of current numerical algorithms; adaptive mesh refinement algorithms; increase the maturity of HoM; overcome barriers to achieving extreme scale computing (load balancing, communication patterns, GPU integration, etc.); development of algorithms for data management, visualisation and modelling and benchmarking of large-scale aeronautical applications.