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MASSIVELY-PARALLEL MULTI-GPU SIMULATIONS FOR FAST AND ACCURATE AUTOMOTIVE AERODYNAMICS

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In this contribution, the scaling properties of the commercial Computational Fluid Dynamics (CFD) solver ultraFluidX are analyzed. The solver is based on the Lattice Boltzmann Method (LBM), is explicit in time, inherently transient and only requires next-neighbor information on the computational grid. ultraFluidX thus highly benefits from the computational power of Graphics Processing Units (GPUs). Additionally, the solver can make use of multiple GPUs on multiple compute nodes through an efficient implementation based on CUDA-aware MPI.

The capabilities of the solver have already been demonstrated to various automotive OEMs around the world through several validation projects. This paper focuses on the scalability of ultraFluidX on single- and multi-node configurations in large-scale multi-GPU environments. Weak and strong scaling results for two selected test cases are reported and demonstrate that multi-GPU flow solvers have the potential to deliver high-fidelity results overnight.

Selected applications of ultraFluidX will be presented at the conference, including passenger vehicles and full truck geometries [1]. The resulting turnaround times are very competitive and allow to embed even highly-resolved, high-fidelity CFD simulations into a simulation-based design cycle.

REFERENCES

[1] Christoph A. Niedermeier, Hanna Ketterle, and Thomas Indinger. Evaluation of the Aerodynamic Drag Prediction Capability of Different CFD Tools for Long-Distance Haulage Vehicles with Comparison to On-Road Tests. In *SAE 2017 Commercial Vehicle Engineering Congress*.