

Benchmarking Hardware with OpenFOAM

- a possible reference case

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Abstract

Computational Fluid Dynamics is a perfect application for use on high performance computation (HPC) systems. Often benchmarks are needed: e.g. to get access to such systems or in case of a bidding invitation for new HPC systems to quantify the performance of the different hardware offers. Although there are numerous well established “synthetic benchmarks” (e.g. SPECS) which could be used, the users often want to see how their application (software) is performing. To our knowledge there is no simple “reference case” to benchmark OpenFOAM available.

We used an established CFD benchmark [1], which has been adopted to be used with OpenFOAM. Since benchmarking is very consuming in terms of time, computer and personnel resources we choose a rather simple case: steady state simulation of the laminar flow around a 3D squared cylinder at $Re=20$, which equal to benchmark 3D-1Q in [1]. The grid size and the residual tolerances are chosen in such way that the serial run of the benchmark can be done in about 24 hours and scalability on more than 100 cores can be achieved. Typical hardware used for HPC system are evaluated and the performances of the different systems are presented. The reference case can easily be modified to benchmark larger HPC systems or smaller workstation systems.

Further more the “reference” benchmark presented is an invitation to the OpenFOAM community to help finding the “most efficient” hardware in terms of CPU, interconnect; the “most efficient” compiler (settings); the most efficient solver (settings); to evaluate different hardware implementation (CPU, GPU); ...

Key words: benchmarking, reference case, 3D squared cylinder, laminar flow

References

- [1] M. Schäfer and S. Turek: *Benchmark Computations of Laminar Flow Around a Cylinder*, In Flow simulation with high-performance computers. Vol. 2, Notes on numerical fluid mechanics; 52 1996