

Cross-Platform Computational Fluid Dynamics at Petascale with Python

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Accurate simulation of unsteady turbulent flow in the vicinity of complex geometric configurations is critical for improved design of e.g. turbine stages, and hence 'greener' aircraft that are more fuel-efficient. In this talk I will demonstrate application of PyFR, a high-order accurate Python based computational fluid dynamics solver, to petascale simulation of flow over low-pressure turbine linear cascades. Rationale behind algorithmic choices, which offer increased levels of accuracy and enable sustained computation at up to 13.7 DP-PFLOP/s on unstructured grids, will be discussed in the context of modern hardware. A range of software innovations will also be detailed, including use of runtime code generation, which enables PyFR to efficiently target multiple platforms, including heterogeneous systems, via a single implementation.