

Technical challenges for GPU-Accelerated Ab-Initio Simulations of Low- and High-Pressure Turbines

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High fidelity Computational Fluid Dynamics (CFD) promises to help achieve efficiency improvements of gas turbines (GT) through shifting from modelling to resolving flow phenomena at unprecedented level of detail. However, resolving all scales of turbulence present in GT constitutes a formidable computational challenge that can only be met by algorithms that exploit the latest GPU accelerated architectures. In the current research effort between General Electric and the University of Southampton, we are leveraging recent advances in high-fidelity CFD due to algorithmic progress and the tremendous increase in computing power to improve our understanding of the unsteady physics that occur in the high-turbulence environment of a GT.

The talk will present porting of the highly efficient hybrid OpenMP/MPI Southampton CFD code to Titan using Open-ACC. In particular the steps required to achieve a noticeable speed-up of the GPU version versus the original hybrid OMP/MPI version and performance studies will be discussed. Results of GPU-accelerated ab-initio simulations at realistic engine conditions will be shown.