

# IMPLICIT LES OF THE TRANSONIC FLOW OVER A HIGH-PRESSURE TURBINE CASCADE USING DG SUBCELL SHOCK CAPTURING

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Scale-resolving simulations are an integral part in the validation of lower-cost computational fluid dynamics (CFD) methods and, with increasing computational resources, are also becoming an attractive tool for the design process in modern-day turbomachinery. Because such flows are typically at high Reynolds numbers, possibly transonic, and strongly affected by the incoming turbulence levels, agreement of experimental and numerical results can be challenging [1]. Among the numerical methods used for these high-fidelity large-eddy simulations (LES), high-order spectral methods, and in particular the discontinuous Galerkin spectral element method (DGSEM), have become popular, as they feature reduced dispersion and dissipation errors over lower-order schemes [2]. Spurious polynomial oscillations can, however, occur at shock fronts and result in unphysical solutions. The development of shock capturing methods tailored for the DGSEM framework is an active area of research and Hennemann *et al.* [3] only recently developed a novel subcell shock capturing approach for the split-form DG method.

We present results from implicit LES of the transonic high-pressure turbine cascade VKI-LS89 under transonic operating conditions using a high-order accurate discontinuous Galerkin spectral element method. The subcell shock capturing method by Hennemann *et al.* [3] is tested and results from simulations with laminar and turbulent inflow conditions are validated against numerical and experimental results from literature. The transonic VKI-LS89 high-pressure turbine cascade is a well-suited test case for the performance of numerical tools given the plethora of numerical references available in literature and the subcell-shock-capturing method is shown to perform well by effectively reducing spurious oscillations across the shock front and acoustic waves while leaving the rest of the solution domain unaffected.

## REFERENCES

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