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Stability analysis of turbomachinery stages using a sliding-plane formalism[1] ANTON GLAZKOV, University of Oxford , MIGUEL FOSAS DE PANDO, University of Cadiz, PETER SCHMID, Imperial College London, LI HE, University of Oxford — At present, much attention is focused towards the optimisation of contemporary aero-engine technology to meet more stringent emission regulations. Multiple scales, thermal effects and acoustics alongside complex geometries in relative motion, such as in rotor-stator configurations, however, still remain significant challenges for detailed understanding and efficient manipulation of these flows. The development of high-order solvers and adjoint-based techniques are therefore of fundamental interest, enabling, for example, stability analyses, control and optimisation. In this study we present a new framework for a time-domain sliding-plane treatment with direct and adjoint functionality, showcasing it with our fifth-order compressible flow solver, and illustrating test cases validating this approach and confirming its robustness. We then perform a linear stability analysis on a representative single-passage, subsonic compressor geometry, and use modal and non-modal techniques to illustrate vortex shedding within a laminar separation bubble and at the trailing edge. We extend this case to a rotor-stator geometry that makes use of the linear and adjoint calculations to compute sensitivities within the flow.

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