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ON THE TREATMENT OF MULTIROW INTERFACE IN AERODYNAMIC TURBOMACHINERY ADJOINT SOLVERS

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Abstract: The currently available computational power and improvements of high-fidelity numerical simulations have lead to an increased use of computational fluid dynamics (CFD) in the analysis of turbomachinery flows, particularly in design environments. The optimization cases often contain up to thousands of design variables and gradient-based (GB) optimization algorithms are typically selected due to their efficiency. The adjoint method is key to efficiently compute the derivatives required by the GB algorithms, with a computational cost nearly independent of the number of design variables. In this paper we present the details of the development of an adjoint multirow interface based on the mixing-plane treatment to extend an already existing adjoint solver using the ADjoint approach. The mixing-plane treatment allows the steady simulation of multiple rows, taking their interaction between one another into account and thus providing more realistic results. A stator/rotor turbine stage of a commercial jet engine is analyzed and some representative sensitivity results are presented and discussed.