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VG OPTIMIZATION FOR TURBOMACHINERY APPLICATIONS

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In order to increase compactness and contain size and weight, current aeronautical compressors are designed with short inter-row gaps. While this can reduce the fuel-consumption, secondary flows and inter-row fluid flow interaction phenomena can have a significant impact on machine-life and in-service performance degradation.
Real blade passage features such as gaps, ramps and bleed slots can strengthen the secondary flows and increase the impact on downstream components.
This work presents a novel way of reducing forced response in a modern axial compressor using vortex generators. CFD simulations are used to perform an optimization of a parameterized vortex generator, positioned in a high-fidelity model of a Ultra-High Bypass Ratio fan passage, with the target of reducing the forced response on downstream components.
After an initial Design of Experiments, the optimization is conducted using a machine-learning surrogate based algorithm trained with the initial database.
The resulting flow-field modifications induced by the optimal device are analyzed in detail with particular attention to the forced response reduction.