

COMPRESSOR BLISK MANUFACTURING GEOMETRICAL VARIABILITY DIGITAL TWIN
FOR AEROELASTIC UNCERTAINTY QUANTIFICATION

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Probabilistic investigations are increasingly present in the study of turbomachinery, allowing evaluating the impact of modelling uncertainties on the machines performance. The geometrical variability is of particular interest when investigating axial compressor aerofoils. Considering the aeroelastic problem, deviations from the nominal cyclic symmetry affect both the structural dynamic of the components and the flow field.

Geometrical deviation from the nominal design are introduced on the components during the manufacturing process. Such deviations are considered as the investigated source of uncertainty for the study of the aeroelastic problem. Optical surface scans of axial compressor aerofoils are used as dataset to measure the complex three-dimensional geometries. A digital twin is defined to probabilistically describe the geometrical differences from the nominal design.

The quantities of interest for the study are the aeroelastic forces acting on the investigated rotor blade integrated disk. The investigated forces depend on the interaction between the vibrating system and the flow field in the machine. The problem is intrinsically unsteady, involving multiple stages and passages of the compressor. The modelling of the geometrical variability and the solution methods for the evaluation of the forces are therefore critical for the feasibility of the uncertainty quantification.