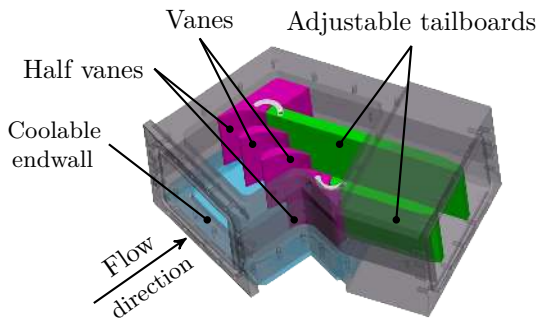


Turbine Endwall Contouring Using Numerical Optimization in Combination with the Ice Formation Method

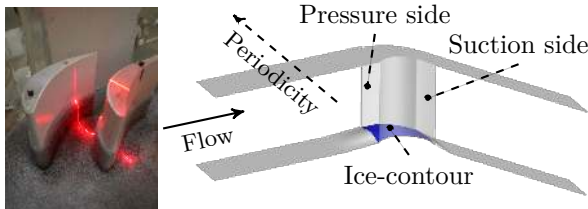
Sven Winkler, Kristian Haase, Bernhard Weigand

1 Experiments



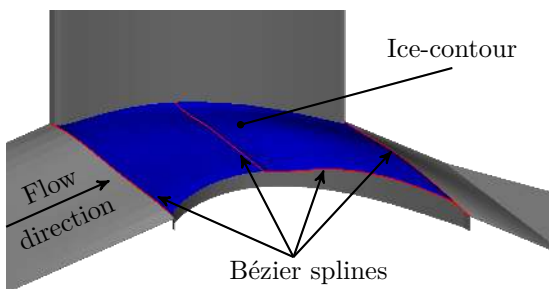
- Modern gas turbines call for high thermal efficiencies and low emission rates → Raising of turbine inlet temperature
- High thermal loading on turbine stages, especially on endwalls of guide vane rows
- Endwall contouring offers efficient means for reducing thermal loading on components
- Present study: Novel endwalls for low pressure guide vane created to reduce endwall heat transfer

2 Digitization and Numerical Domain



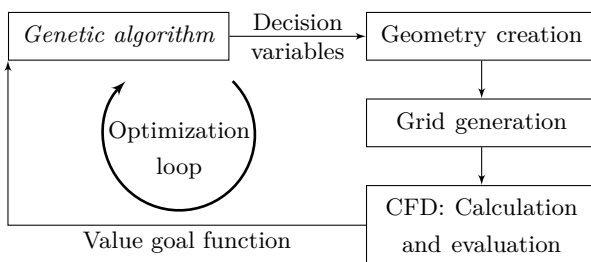
- Methodology: Genetic optimization algorithm coupled with three-dimensional fluid dynamics; experimentally created ice-contours as initial geometries
- Experimental creation of ice-contoured endwall shapes in water flow channel

3 Parametrization



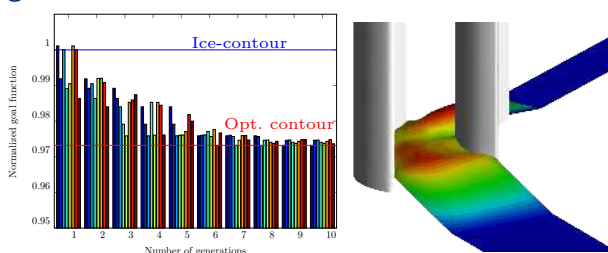
- Digitization of generated ice-contours by means of laser scanner
- Integration in numerical solution domain; digitized ice-contour constitutes endwall between pressure and suction side
- Parametrization of digitized ice-contour with Bézier splines
- Numerical optimization using genetic algorithm in conjunction with three-dimensional fluid dynamics
- 10 generations simulated, each holding 8 individuals per generation

4 Numerical Optimization



Final endwall contour exhibits reduction of averaged endwall Stanton number of 12.8%

5 Optimized Contour



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