HIGH PERFORMANCE CENTER

DYNAFLEX®

FLEXIBLE SOLUTIONS FOR THE ENERGY TRANSITION AND RAW MATERIALS SHIFT

AUTOMATED OPTIMIZATION OF TURBOMACHINERY

IMPROVED BLADE/VANE DESIGN WITH LOWER REDESIGN COSTS IN SHORTER TIME

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Despite of available 3D-Flow simulation (CFD) tools it is still a time intensive job to optimize turbomachinery blade and vane geometries. Using a multi-core cluster in combination with a very robust parametrizing tool and CFD workflow basically enables a full stage optimization with the variation of 30+ parameters. Fraunhofer UMSICHT has developed an application-oriented full range and full stage automated optimization workflow which is capable of optimizing vane geometries and will be further enhanced to optimize blade geometries. The main features include 1) a new developed filter-algorithm for unconverged CFD-results which delivers an accurate surrogate model for optimization and 2) a method to flexibly vary optimization criteria on the needs of the application. For example the slope of the pressure coefficient curve for compressors can be chosen as target function.

Keywords

- Coupling of modelling (Excel, MatLab, ANSYS CFX etc.) and optimization-techniques (ANSYS OptiSLang)
- Shorter design workflow
- Lowering development/redesign costs
- Performance-upgrade
- Turbomachinery in general, esp. for flow guiding components

Industrial Sectors

- Turbomachinery developers
- Turbomachinery and spare parts manufacturers (development/revamp)
- Service providers
- Turbomachinery operators

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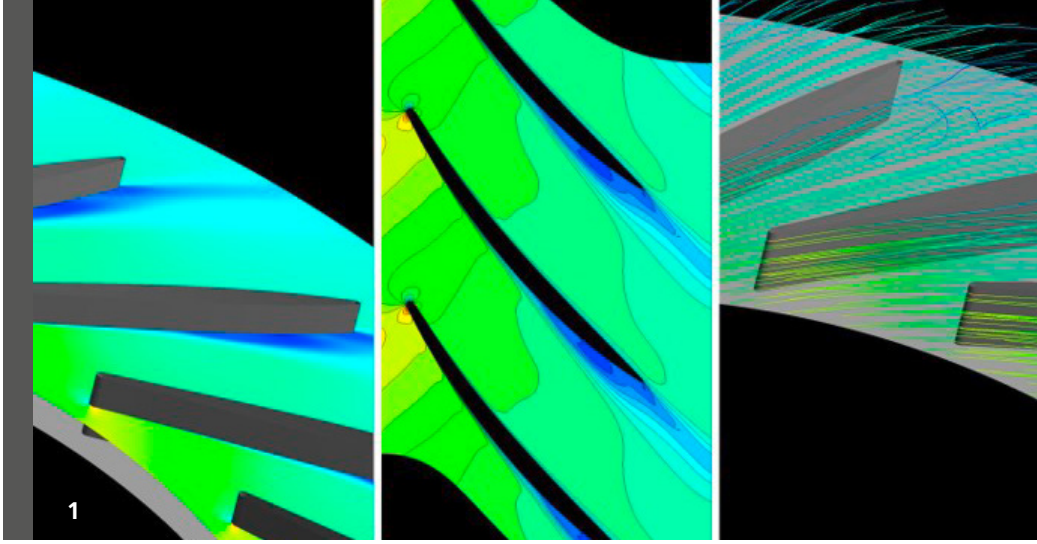

1 *Test case: 2D and 3D evaluation of a radial diffuser geometry during an automated optimization (left and center: Mach number contour at 50 % span, right: streamlines). In this test case a radial diffuser design tool (MatLab) was coupled to a multi objective optimizer (OptiSLang). Based on the variation of 6 parameters, a design of experiments (DoE) was carried out. For DoE, various designs (e.g. latin hypercube sampling) were automatically generated and simulated by using CFD (ANSYS CFX). This is followed by an automated filtering of non-converged CFD-results. By using the filter algorithm, system explainability (coefficient of prognosis) in the test case increased from 76 % to 96 % whereby a very accurate surrogate model for the optimization was established. The high accuracy of this surrogate model was proven by comparison of the surrogate predicted results and subsequent gained direct calculated CFD results. Both were in good agreement.*

Technological specification

- Increase of efficiency with the possibility to optimize Off-design conditions
- Adaption to various design questions with different input parameters possible
- Automated filtering of unconverged CFD-Results (based on standard deviation criteria) → very high robustness of optimization process
- Possibility of direct and indirect optimization (via surrogate model) and combinations thereof
- High flexibility to speed up the adjustment of the workflow to new systems
- Geometry parametrization: Matlab
- CFD-solver: ANSYS-CFX
- Optimization-solver: OptiSLang

Our service

Based on your stage design, we deliver an optimized stator geometry and thereby improve your compressor characteristics significantly – with the same range!

Depending on boundary conditions and application needs, we offer individual project solutions.

We offer professional communication with a competent partner with extensive experience and a huge development network.

Your benefit

Reduce product development time and costs.

Outsourcing of individual projects:

- Time critical projects
- Revamp
- Resource-binding
- Requirement of new IT-methods
- Assessment of computational optimization solutions for your problems

Keep and increase your technical lead in the market.

Further information
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