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Lifetime Studies of Gas Turbines

Probabilistic Analysis of Geometric Variations and their Impact on the Lifetime of a Gas Turbine Case

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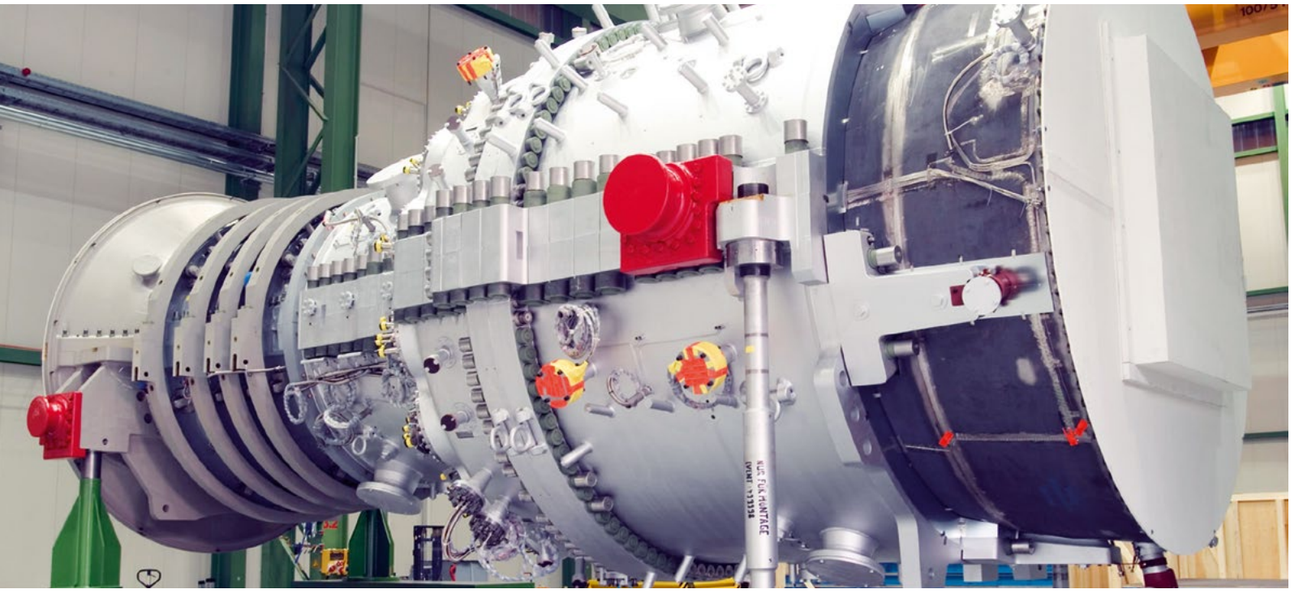
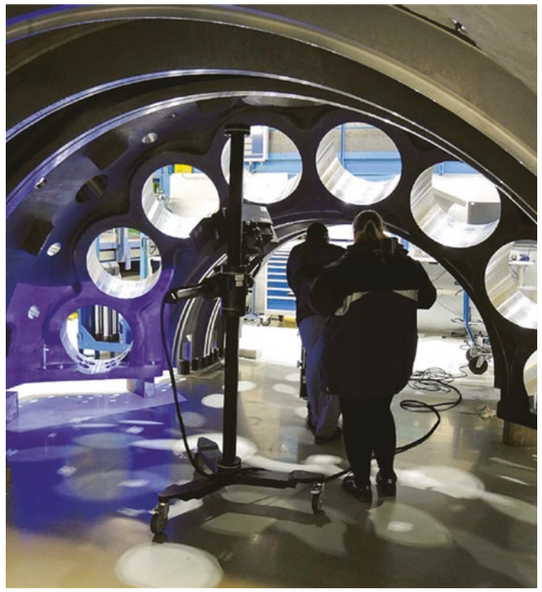


Photo by courtesy of Siemens Energy GmbH



Measurement of the real geometry of a turbine housing using laser scanning

ITB for Siemens Energy GmbH

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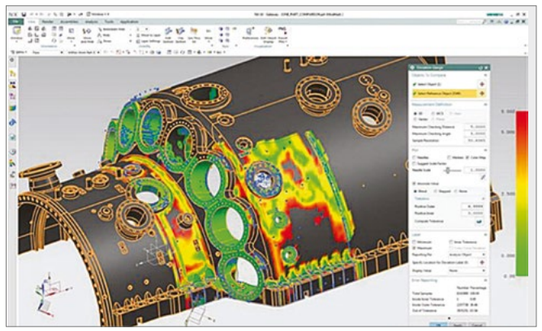
Gas turbines are among the most heavily loaded machines. Operation pressures, as well as particularly high temperatures and the resulting stresses, present significant challenges for the design engineer. The mechanical behavior of gas turbines is also characterized by materials exhibition high nonlinear behavior with temperature-driven long-term effects. And the contract situations of the components are complex.

At the same time, the development of gas turbines is driven by the need to increase lifespan while simultaneously extending maintenance intervals. Siemens AG approached our company with the question of investigating the impact of manufacturing tolerances on the lifespan of a gas turbine. Specifically, the goal was to study lifespan of a gas turbine case in a Low-Cycle Fatigue (LCF) range.

Manufacturing tolerances were first captured on gas turbine casings using 3D laser scanning. Based on the measurement data, CAD models of the actual state of the gas Turbine casings were created. The challenge here was handling the large amounts of data and creating parameterized CAD models as a prerequisite for the subsequent sensitivity analysis with the optiSLang software system. To increase the number of geometry variations, additional artificial geometries based on the measured gas turbine casings were generated using synthetic random field models.

Siemens AG produces large gas turbines for power generation, such as the SGT5-8000H with 400 MW or the CCPP up to 600 MW.



Post-processing of the laser scan data in Siemens NX

RESULTS

- Tolerances and geometry parameters were identified that have a significant or no significant influence on the service life of the gas turbine.
- Tolerance zones of the gas turbine housing have been redefined in order to extend maintenance intervals and thus also the service life of the gas turbine and to reduce manufacturing costs.

simulations driven by engineering excellence

We accelerate our customers‘ innovations through virtual simulations and precise calculations of physical and technical requirements. We transform our results into practical solutions that enable our customers to achieve excellence in engineering technology.

Dr. Frank Brehmer,
Managing Director ITB

Our services

- Component Strength Analysis
- CAD Construction
- Component Verification
- Electrothermal Simulation
- Flow Simulation
- Light Simulation

Are you planning your next project and want more security from our expertise? Then get in touch with us:

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