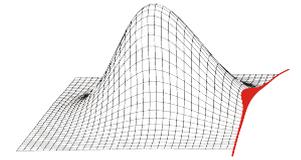


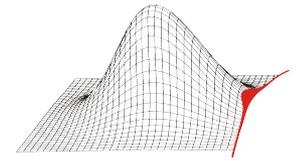
"Ermittlung von geometrischen Produktionstoleranzen mittels 3D-Messtechnik und ihre Auswirkungen"

Kay Heinze
Technische Universität Dresden



Die Produktion von Bauteilen unterliegt Streuungen:
- z.B. durch Abnutzung der Fertigungswerkzeuge

Der Einfluss dieser Streuungen auf das aerodynamische, strukturmechanische und strukturdynamische Verhalten ist weitgehend unbekannt.



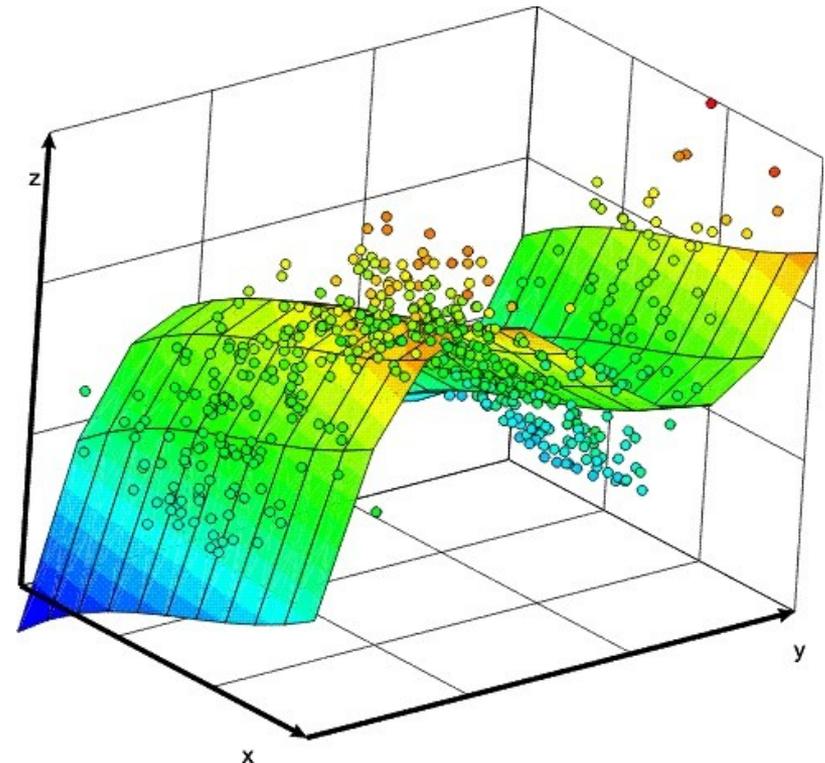
Für die experimentellen und numerischen Untersuchungen am Lehrstuhl ist eine exakte Kenntnis der Schaufelgeometrie erforderlich.

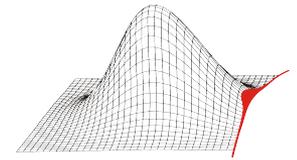
mehrere Turbomaschinen-
prüfstände



Kay Heinze

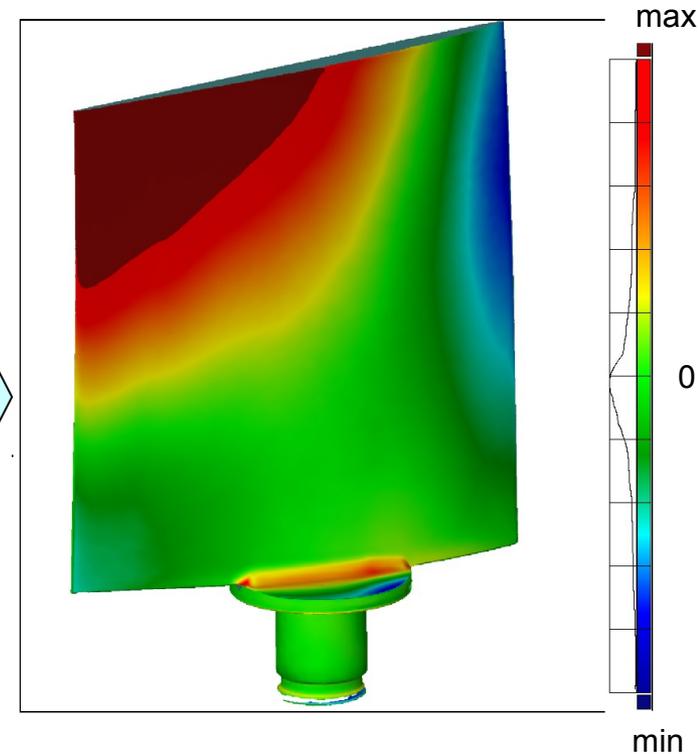
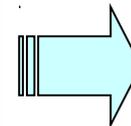
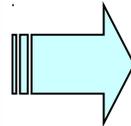
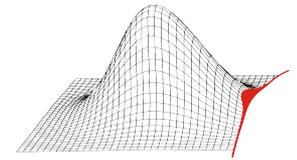
Probabilistik



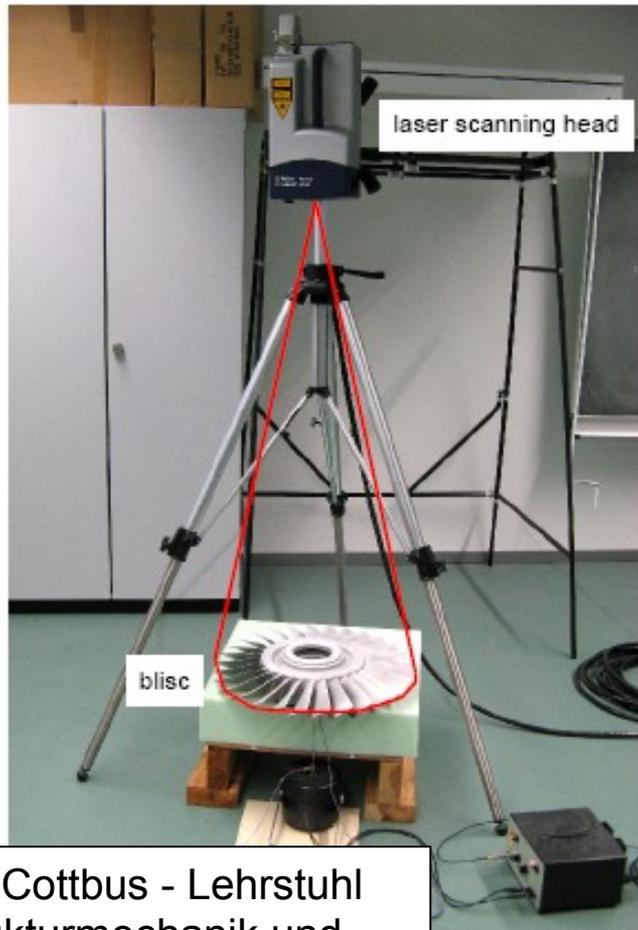
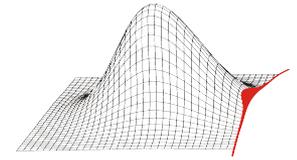


3D-Scanner ATOS SO 4M von GOM

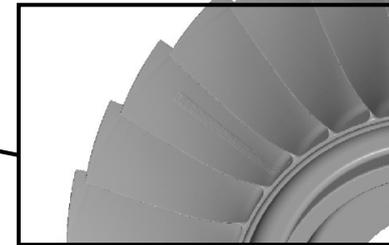
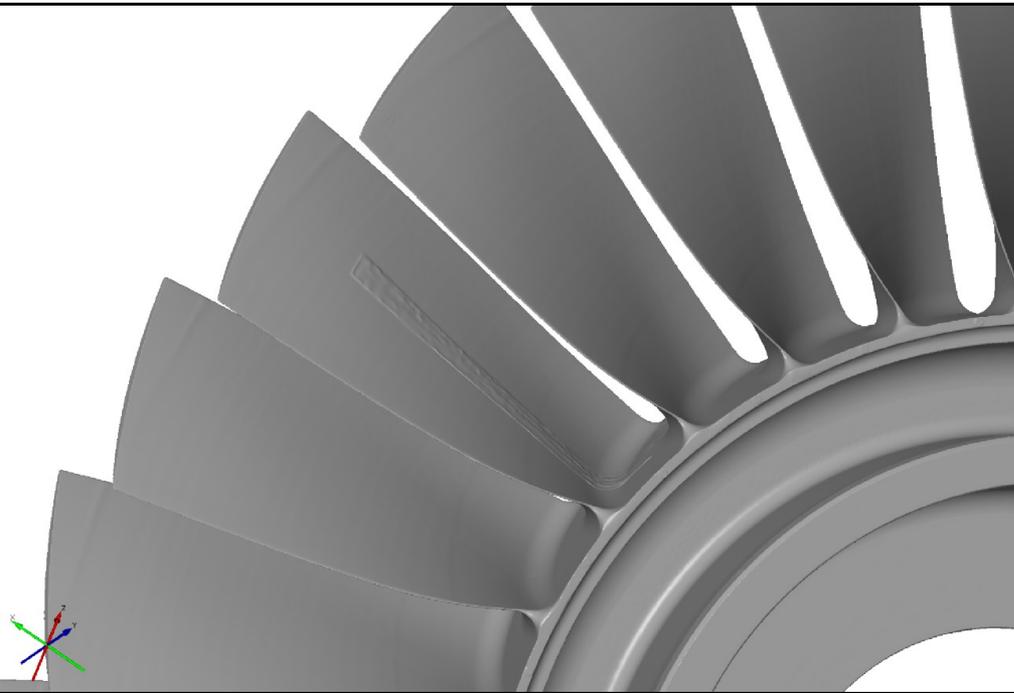
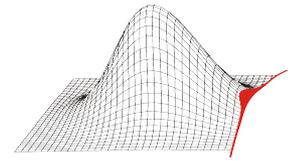
- 2x 4M Pixel Kameras
- Messfeldgröße 30mm x 30mm -
300mm x 300mm
- Punktabstand: 0.015mm - 0.15mm
- Optisches Streifenprojektionsverfahren
- Messgenauigkeit nach DIN beträgt
0.005 mm
- Multiachsverfahreninheit



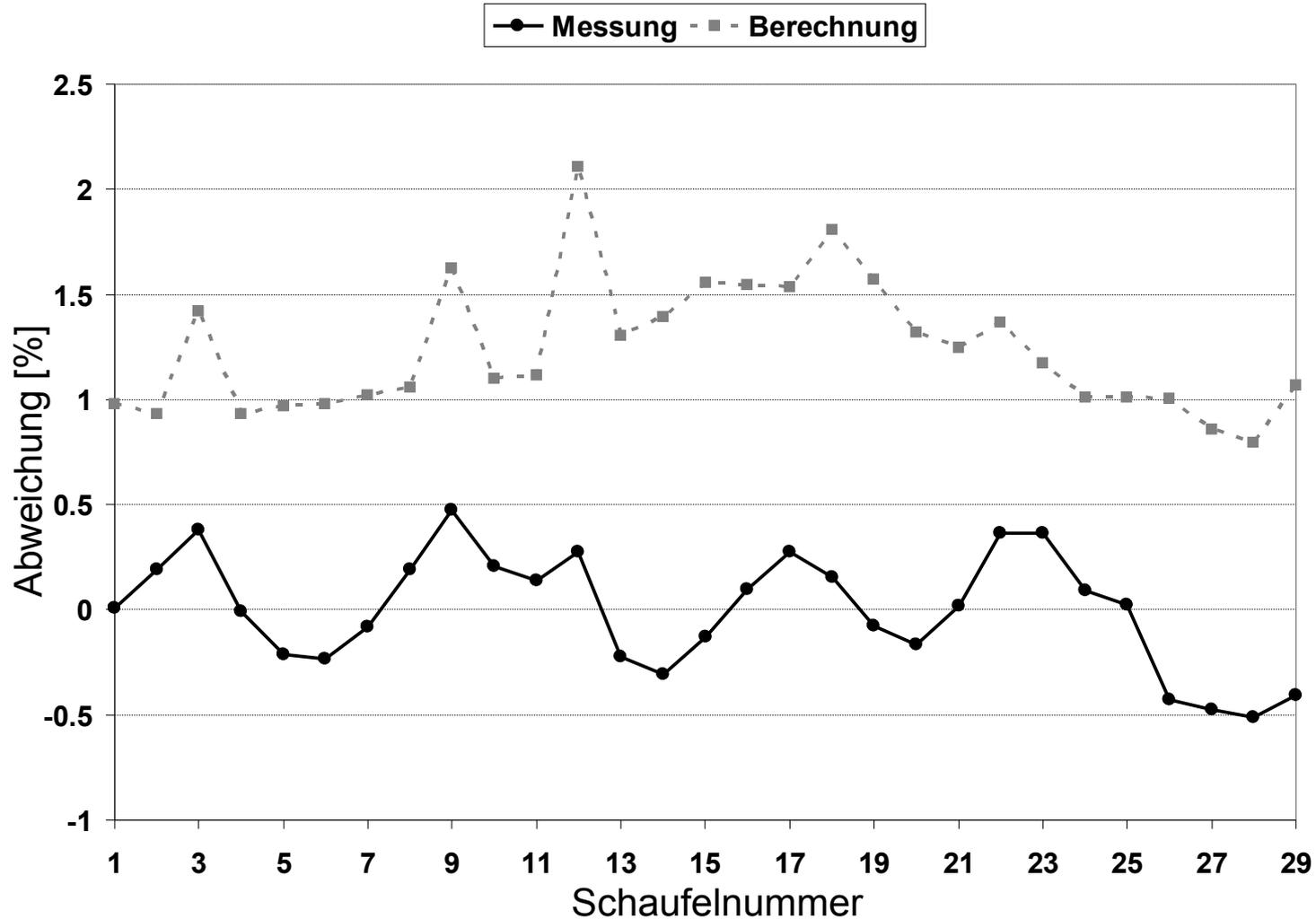
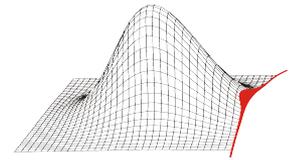
Schaufel wurde mittels Spritzguß gefertigt. Anhand der Abweichungscharakteristik können Rückschlüsse auf den Fertigungsprozess gezogen werden → Negativform muss angepasst werden.

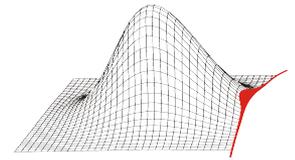


BTU Cottbus - Lehrstuhl
Strukturmechanik und
Fahrzeugschwingungen

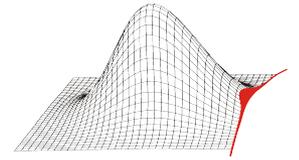


Detaillierte Erfassung der kompletten Geometrie.

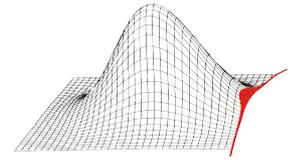




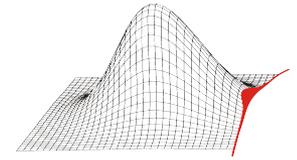
Einsatz der Messkabine für hohe Anzahl zu digitalisierender Schaufeln.



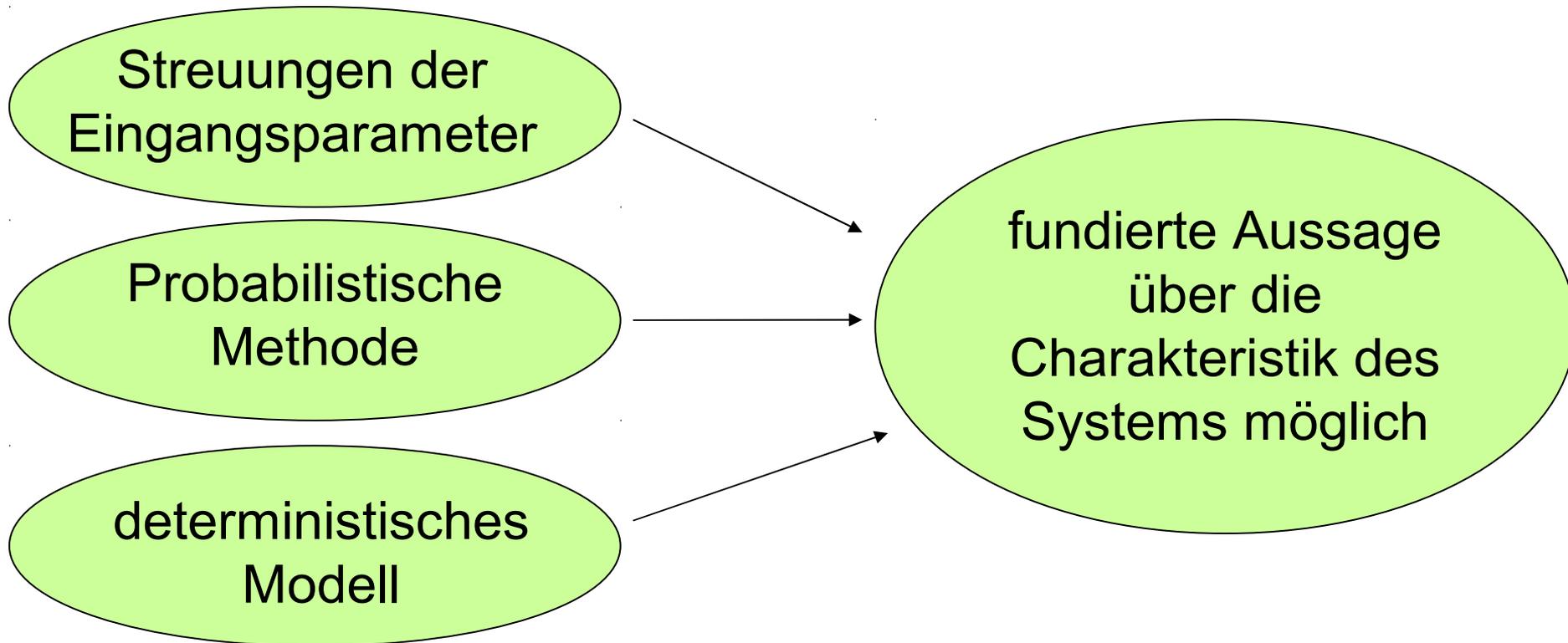
Verlauf der Sehnenlänge über die Schaufelblatthöhe von 30 gescannten Schaufeln.

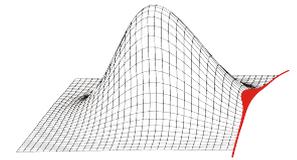


Radius zwischen Plattform und Schaft auf der
Druckseite.

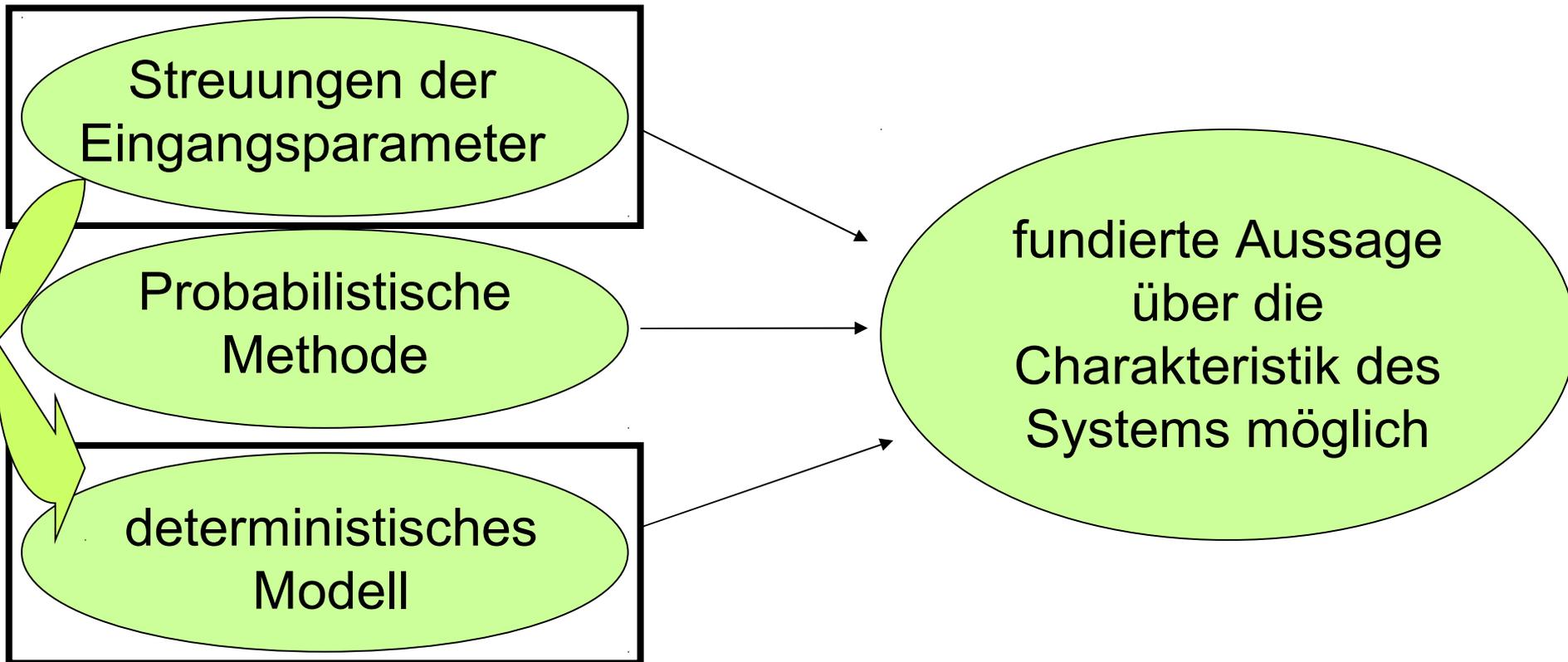


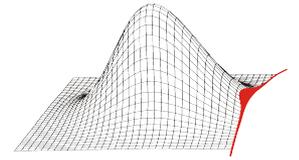
Einfluss der Geometriestreuung auf Systemcharakteristik der Schaufel kann mittels der Probabilistik ermittelt werden.

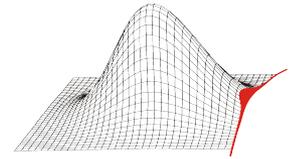


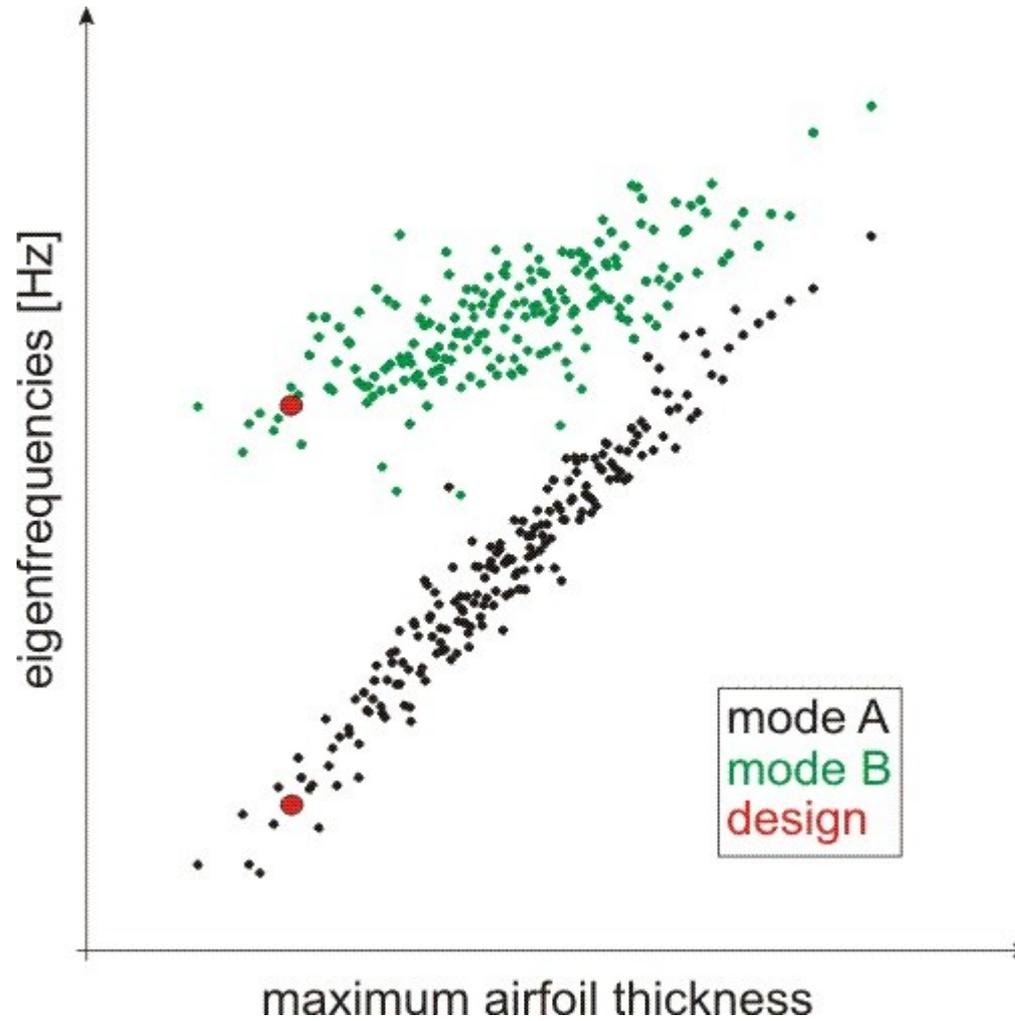
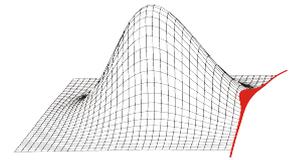


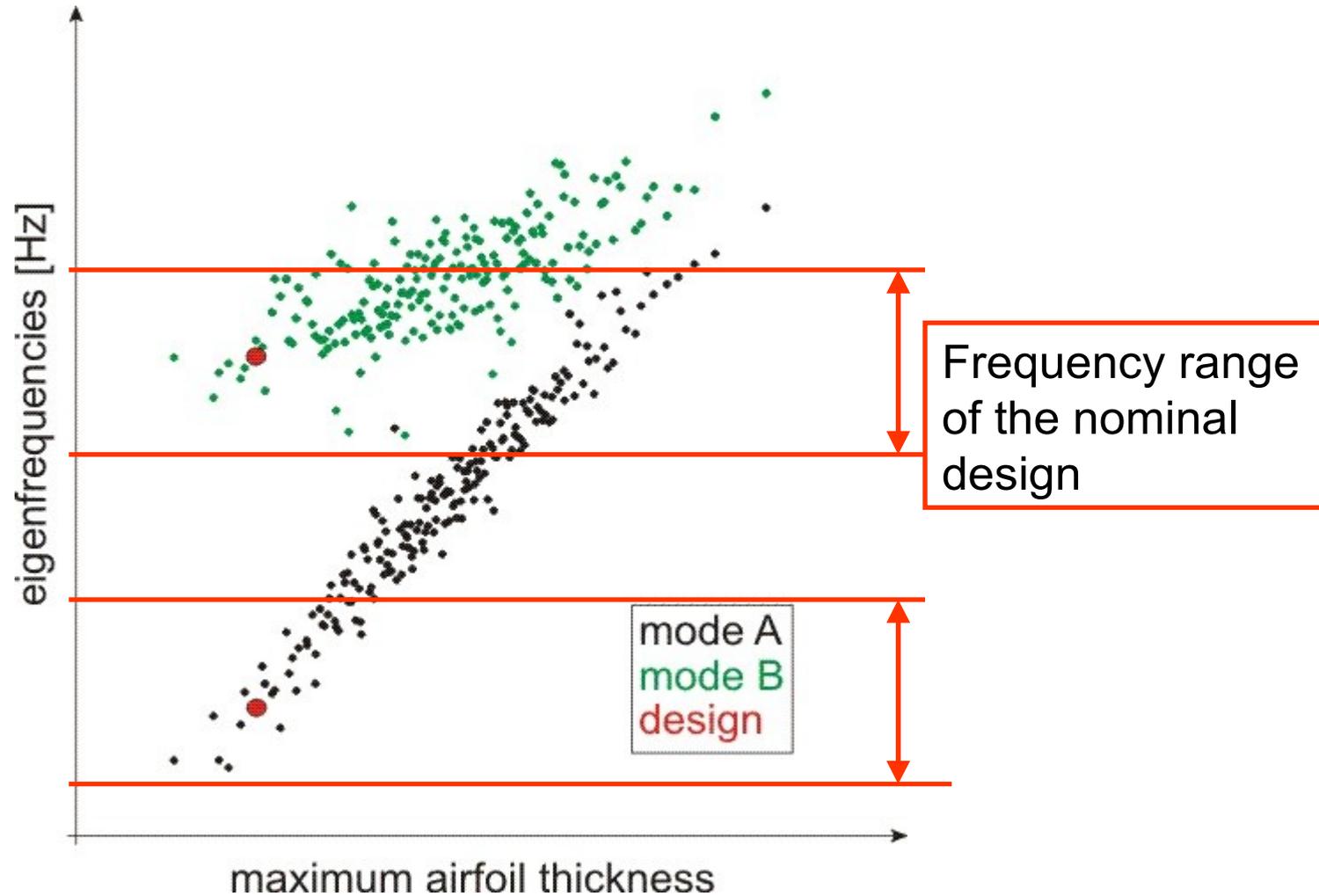
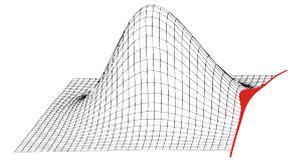
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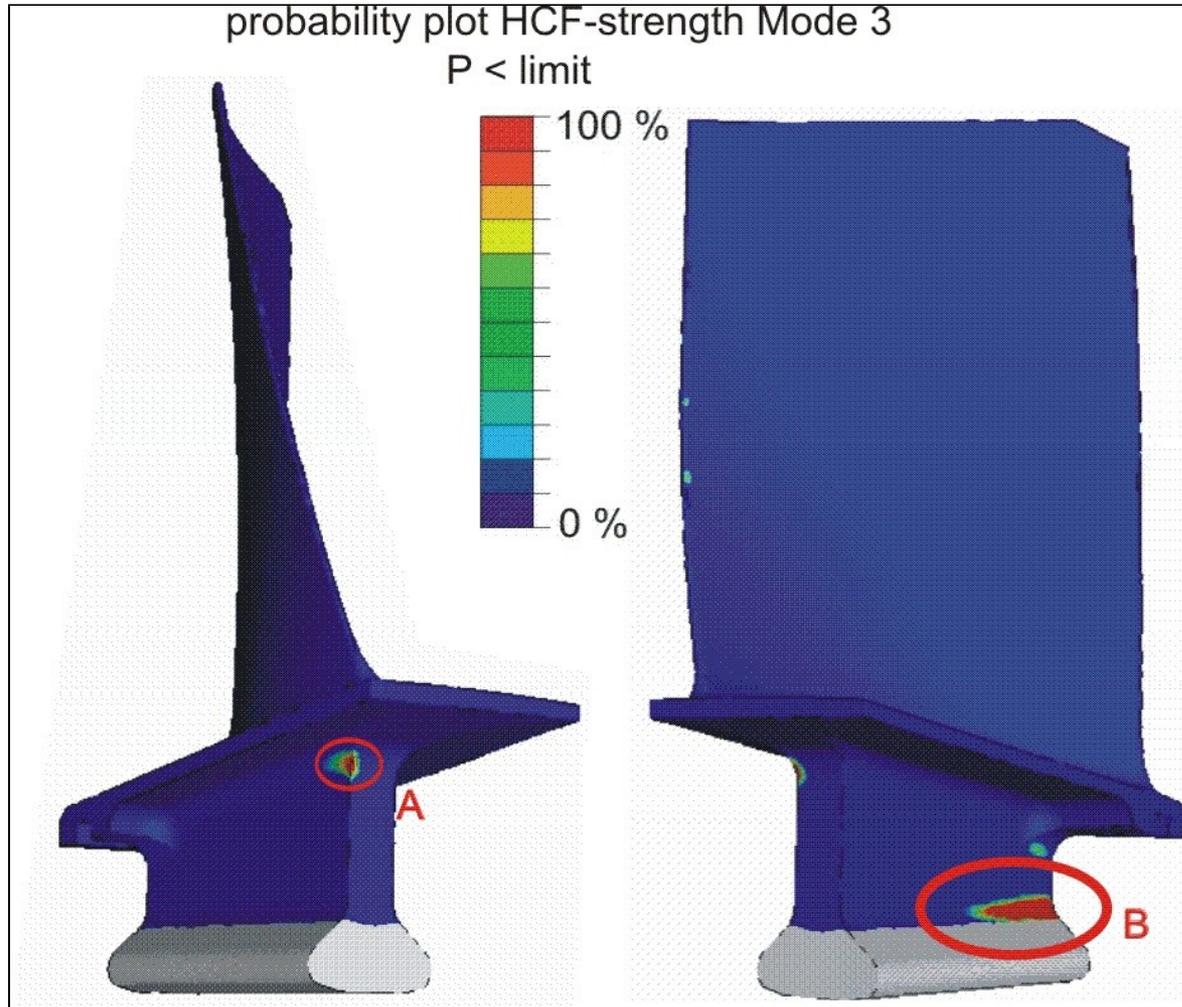
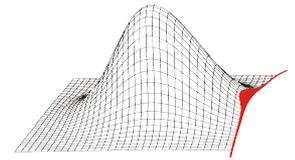


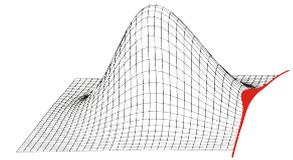




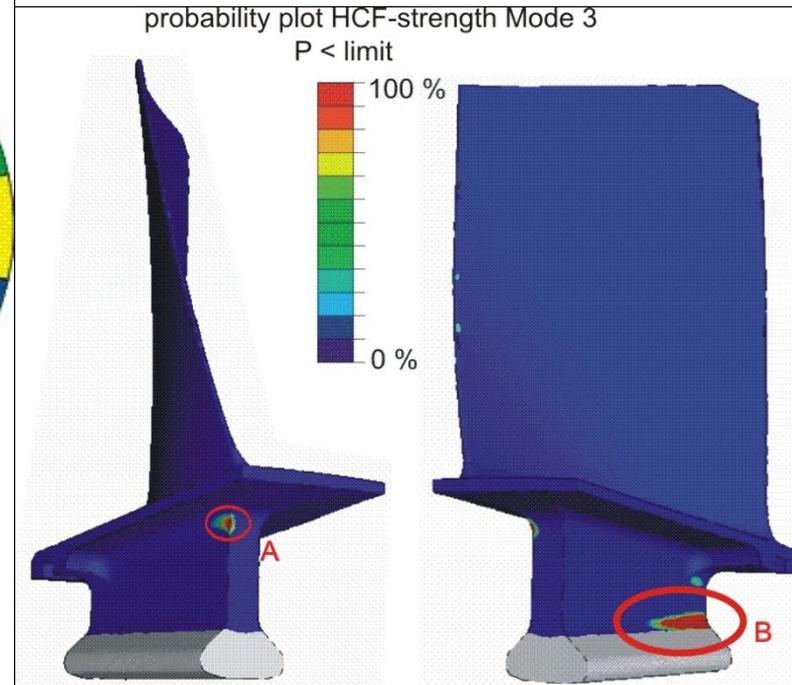
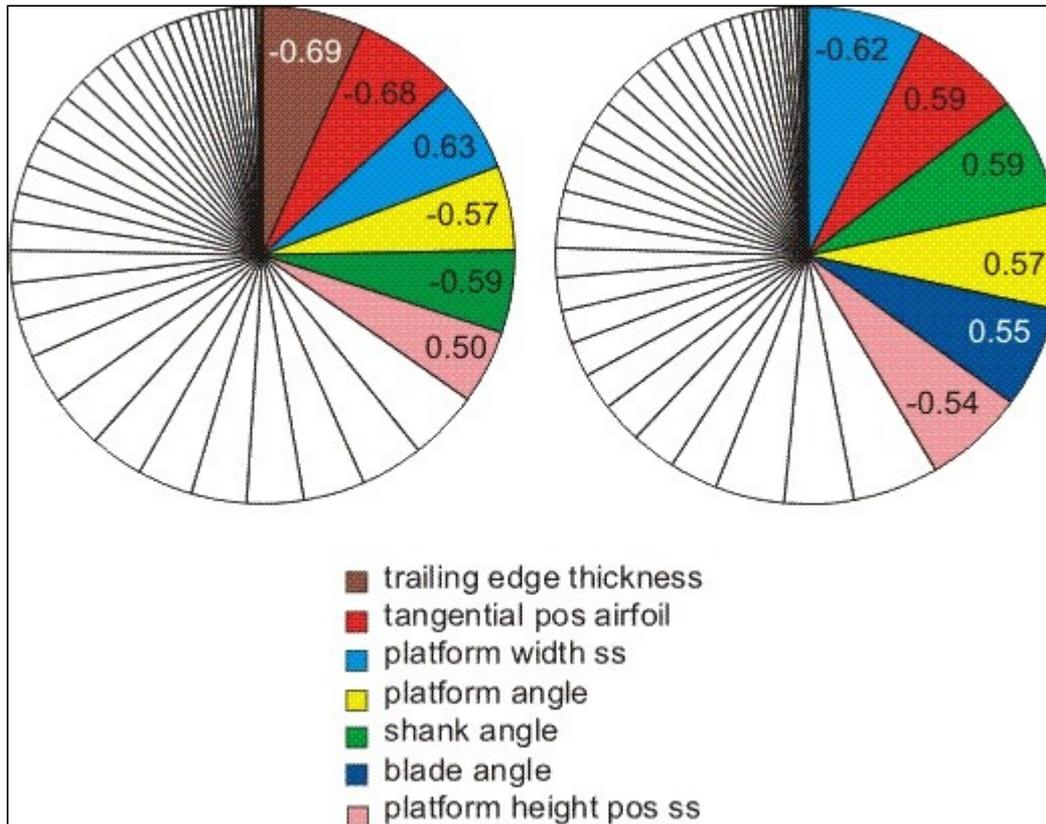


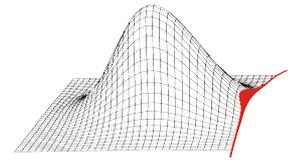




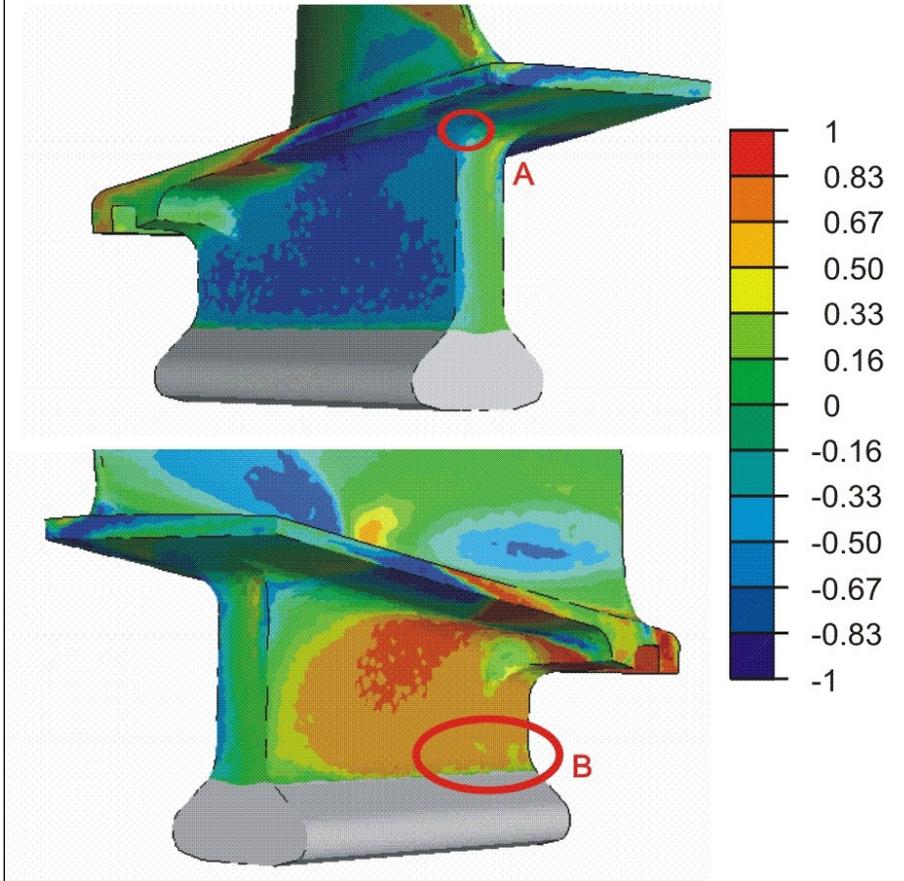


Pie Chart HCF-strength Area A and Area B

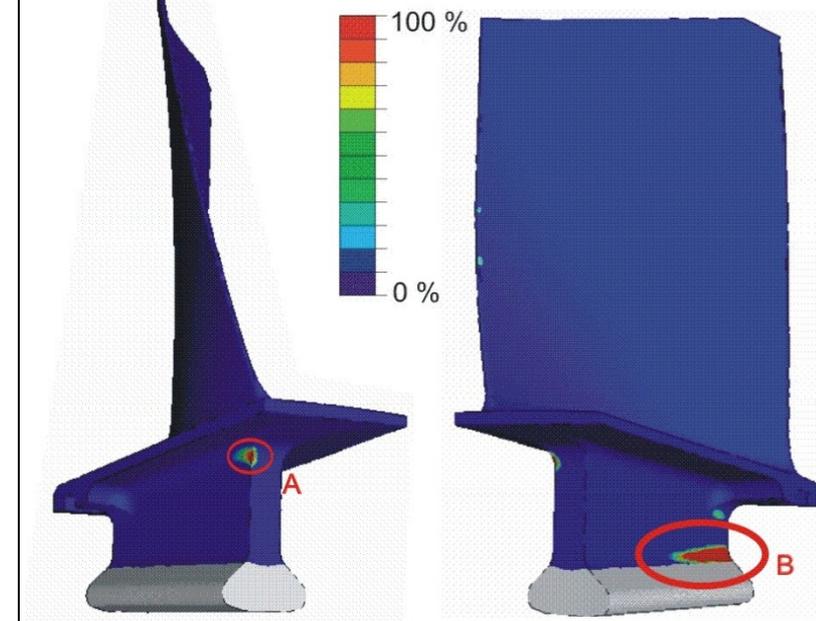


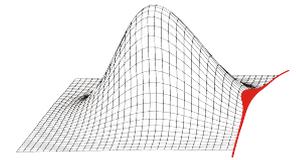


Correlation plot of tangential airfoil position vs HCF-strength



probability plot HCF-strength Mode 3
P < limit





- A. K. Heinze, W. H. Friedl, K. Vogeler
“The Impact of geometric scatter on High-Cycle-Fatigue of Compressor Blades“
ASME Turbo Expo, GT2010-22083, Glasgow, 2010
- B. K. Heinze, W. H. Friedl, K. Vogeler, M. Voigt
“Probabilistic HCF-Investigation of Compressor Blades“
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- C. A. Lange, K. Vogeler, V. Gümmer, H. Schrapp, C. Clemen
“Introduction of a parameter based compressor blade model for considering measured geometry uncertainties in numerical simulation”
ASME Turbo Expo, GT2009-59937, Orlando, 2009
- D. A. Lange, M. Voigt, K. Vogeler, H. Schrapp, E. Johann, V. Gümmer
“Probabilistic CFD simulation of a high-pressure compressor stage taking manufacturing variability into account”
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- E. M. Voigt, R. Mücke, M. Oevermann, K. Vogeler
“Probabilistic Lifetime Analysis for Turbine Blades Based on a Combined Direct Monte-Carlo and Respond Surface Approach“
ASME Turbo Expo GT2004-53439, Austria, 2004
- F. T. Weiss, M. Voigt, H. Schlums, K. Vogeler, R. Mücke, K.-H. Becker
Probabilistic Finite-Element Analyses on Turbine Blades.
ASME Turbo Expo, GT2009-59877, Orlando, 2009
- G. T. Bischoff, M. Voigt, E. Chehab, K. Vogeler
“Probabilistic Analysis of Stationary Gas Turbine Secondary Air Systems“
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