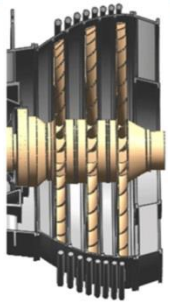


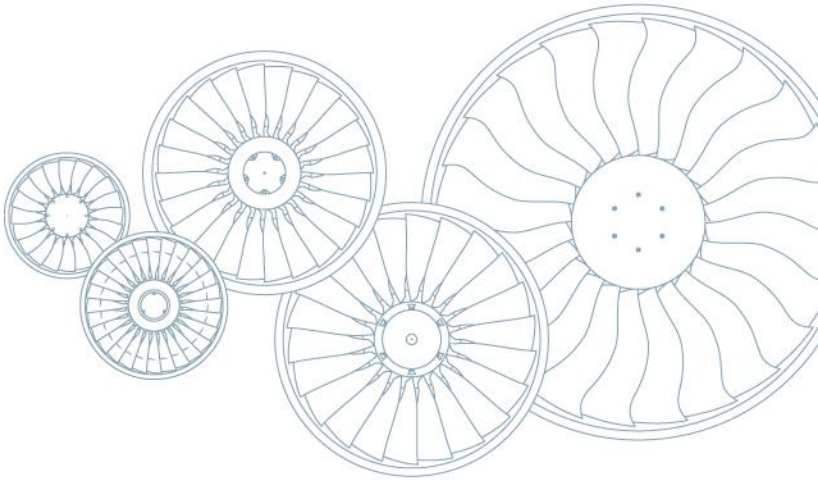



Die Rolle der Fertigung für die Triebwerkstechnik

Technology & Engineering Advanced Programs – TET

Honorarprofessor Dr. Thomas Uihlein

Cottbus, January 28th 2016



Persönliche Laudatio

2009 Besuch MTU Triebwerksmuseum

2012 BTU

2013 10 Jahre Triebwerkstechnik

- 13 Jahre Zusammenarbeit seit den ersten Vorarbeiten zum Studiengang
- SS2005 Start Vorlesung „Verfahren in Fertigung, Montage und Instandhaltung“ in der Triebwerkstechnik
- Gemeinsame MTU-Vergangenheit
- Persönliche Erfahrung mit Prof. Kühhorn und dem Lehrstuhl für Strukturmechanik und Fahrzeugschwingungen

The vital role of fabrication for discipline „Triebwerkstechnik“ respectively the interdependency with further disciplines

Konstruktion/ Design

Strukturmechanik Thermomechanik

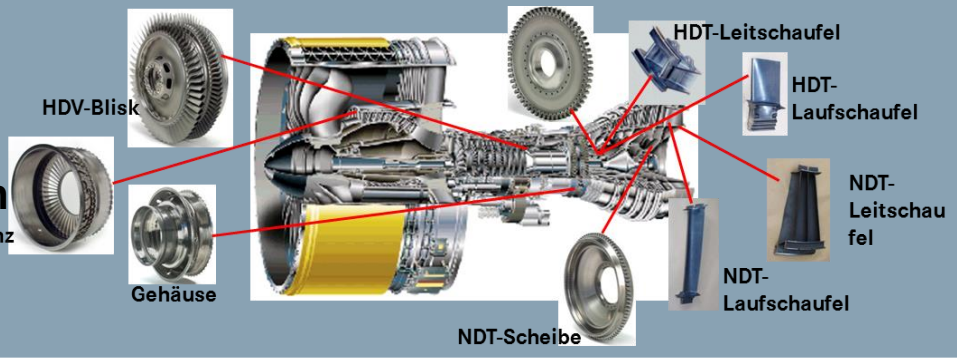
Werkstofftechnik/ Materials

Ur-, Umformbar? Castable, formable?

Properties?

Werkstoffe? / Materials? Eigenschaften? / Properties?

Fertigung/ Fabrication



Fertigbarkeit? Producibility?

Influence?

Prüfbarkeit?/ Testability?

Aerodynamik/ Aerodynamics

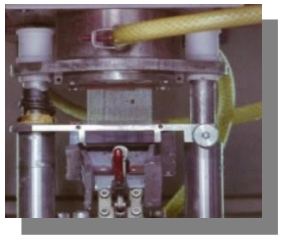
Weitere Disziplinen … Further disciplines

Qualitätssicherung/ Quality

Approach to integrate fabrication into „Triebwerkstechnik“

Production processes

Grinding



Electro-chemical fine drilling

Laser drilling

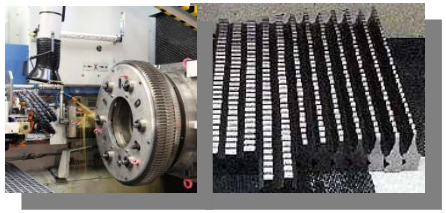
Turning

Studienrichtung Triebwerkstechnik

STUDIENRICHTUNG

TRIEBWERKSTECHNIK

b-tu DLR MTU Aero Engines Rolls-Royce



Broaching

Dimensional testing

Crack detection

Coating

Heat treatment

Engine parts need a lot of production processes

Future of production? Digital Factory – “Industrie 4.0”

Intelligent
Machining & Production

Synthesis &
Optimization

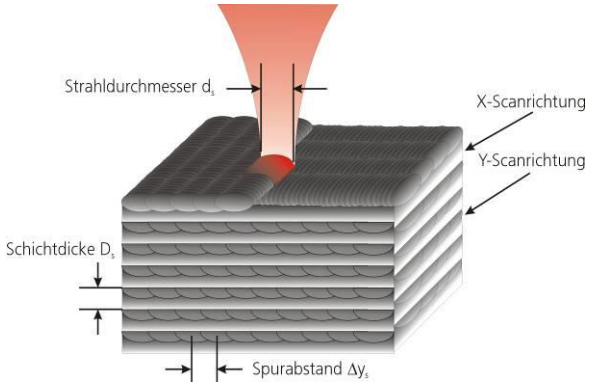
Data Sources
- Drawings
- Resources, materials
- Production plan
- Process descriptions
- Tool characteristics
- Etc.

Challenges

1. Connection of data from all relevant sources
2. Direct link from drawing to tooling and machine
3. Numerically optimized machining
4. Intelligent machine tools with on - condition monitoring and fault diagnosis
5. Numerical integration of systems and processes

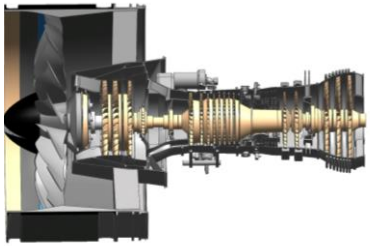
Highest level of design-, machining-, tools- and process-integration.

New production process: Additive Manufacturing



→ **Potential for 30% of Engine parts**

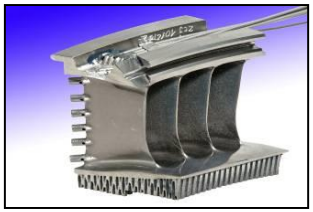
Challenges



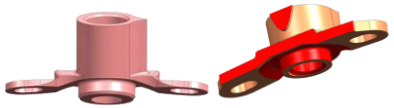
- Material Quality
- Surface Quality
- Process Stability
- Certification Rules

Parts for Rig and Product

Rig: Airfoil integrated measurement devices



Bosses/ Boroscope Boss



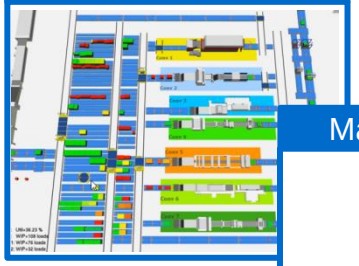
Bionic fastener

AM will open possibilities for new designs, integration of functions or weight reduction

Growing needs for simulation in production

Levels of consideration

Fabrikebene

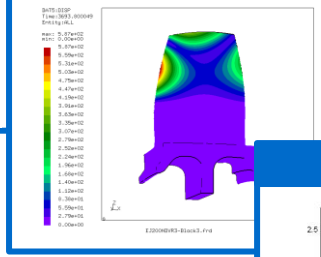


Factory scale:
- Automation for higher productivity, quality
  Optimization of logistics, flow of material

Maschinenebene

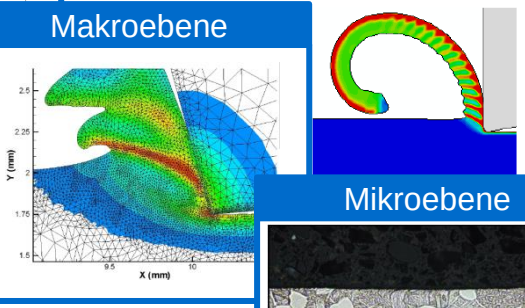
Machine Scale:
- Machine properties (e.g. stiffness)
- Surface quality and machining time

Bauteilebene



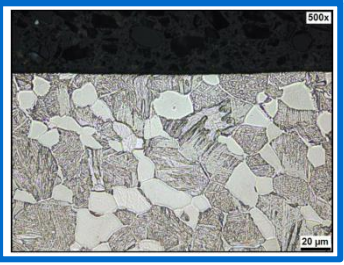
Parts Scale:
- Parts behaviour (deformation, stresses, vibrations)
- Thermo-mechanical interdependencies

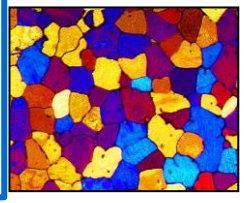
Makroebene



Macro Scale
- Prediction and optimization of cutting parameters

Mikroebene





Micro Scale:
- Analytical material design
  Material properties
- Lifing model

Simulation for better understanding and improved prediction capabilities

Simulation of fabrication und assembly processes

Assembly floor MTU München
ca. 1990

Simulation

Assembly floor MTU München
ca. 2010

By simulation of fabrication to assembly concepts with autonomous conveyor vehicles

Innovation is key to our success …

thank you for your attention and good luck for many next years!