

Simulation

Calculation

Dimensioning

Strength Analysis

Documentation

Partner for FEM Competence in Detail

Competence as flexible service

Business

As an engineering company for technical calculations, we offer our customers an industry-wide scope of services from simulation and calculation to design and strength assessment of components. The major focus is on the implementation of mechanical calculations using the finite element method mainly for mechanical and plant engineering, rail vehicle engineering and automotive engineering.

Team

We provide our services as a team of more than ten engineers who have – owing to our academic education – sound knowledge in the fields of mechanics, dynamics and numerical methods.

Due to continuity in the personnel of the team, we are a group of engineers with many years of professional expertise as well as substantial know-how related to industries, products and software.

Industries

- plant engineering
- mechanical engineering
- rail vehicle engineering
- automotive engineering

Scope of services

- static and dynamic analysis
- crash and impact simulation
- heat transfer analysis
- component optimization
- strength according to standards
- screw calculation according to standards
- weld assessment
- auditable documentation

Used Software

- | | |
|------------------|---|
| CAD: | <ul style="list-style-type: none"> ■ CATIA V5 ■ ANSYS Design Modeler |
| Calculation: | <ul style="list-style-type: none"> ■ ANSYS ■ ANSYS Workbench ■ LS-DYNA |
| Post Processing: | <ul style="list-style-type: none"> ■ ANSYS ■ LS-PrePost ■ IWM Verb ■ WIAM® fatigue RIFEST |

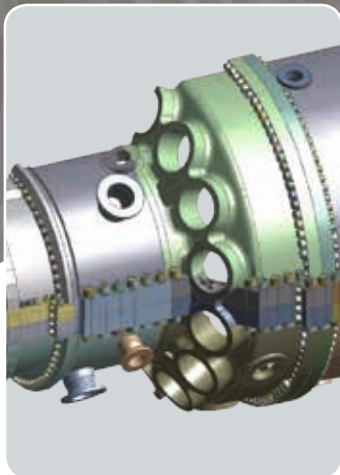
Customer focus

A customer-oriented organization and continuous collaboration with our customers have resulted in specific expertise that allows us to solve problems efficiently and reliably. Flexibility within the team and a high level of commitment to the company, combined with a high degree of personal responsibility, characterize our employees and guarantee our customers an efficient and punctual completion of their projects.

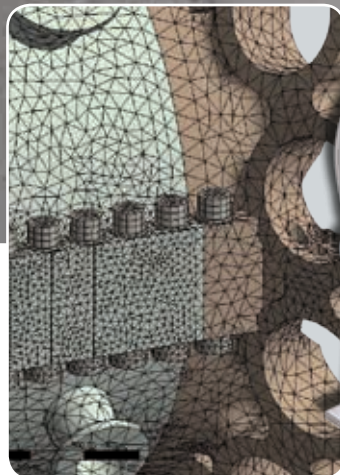
Seminars and Workshops

Based on our project experience and besides our calculation services, we offer seminars and workshops on the finite element method and numerical calculations in our offices or on site at our customers. The experience gained from projects is integrated in our practical seminars and workshops to solve customers' problems optimally.

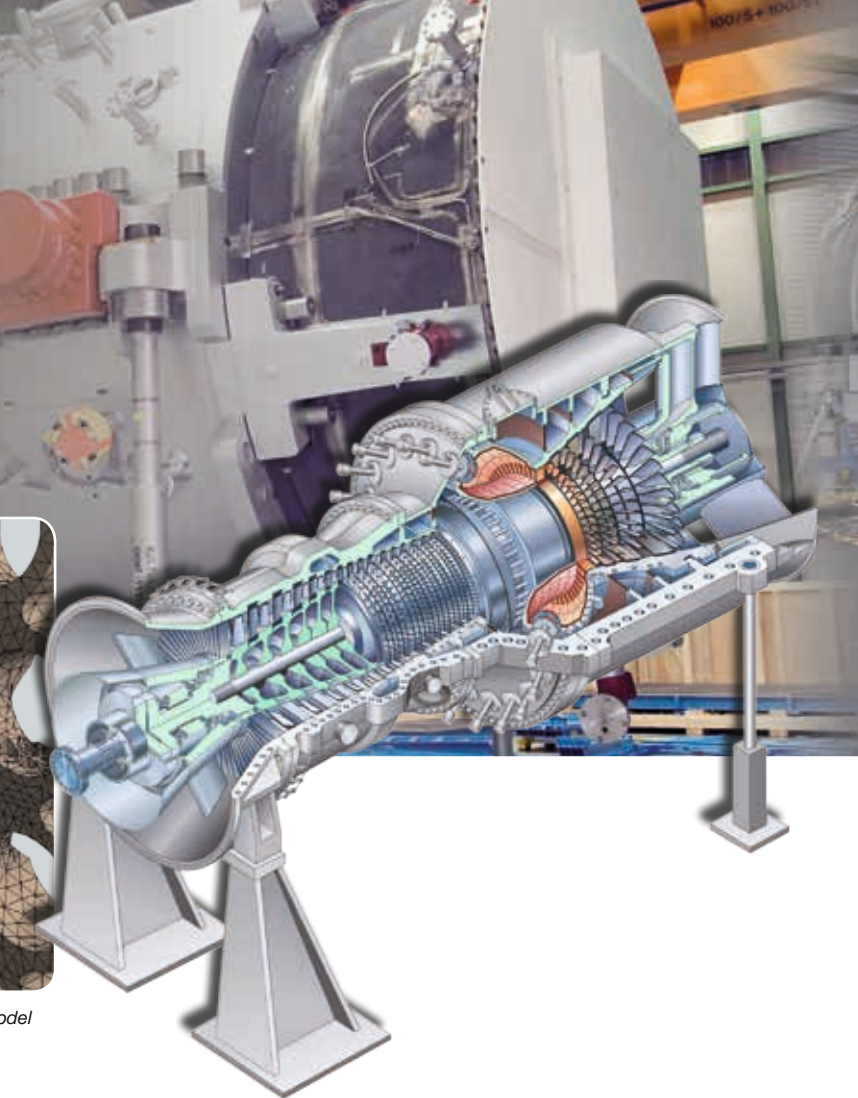
Regular participation in courses and conferences, and a close contact to universities ensure a continuous internal and external exchange of experience.



Strength Assessment



Casing of Gas Turbines - FE-model



Mechanical and Plant Engineering

Gas turbines

Components of gas turbines are subject to time dependent deformations and stresses due to gas flow and high temperatures especially during start-up and shutdown. Components complex and computationally intensive analyses to determine the stresses are required for the proof of usability and the design of such components.

The calculation models typically describe the transient behavior, the thermal and the mechanical contacts and the pre-tension of bolted joints in the use of elastic-plastic approach and temperature-dependent material laws. As the deformation behavior of the components should be evaluated with regard to possible gaps, the requirements on a detailed modeling are high.

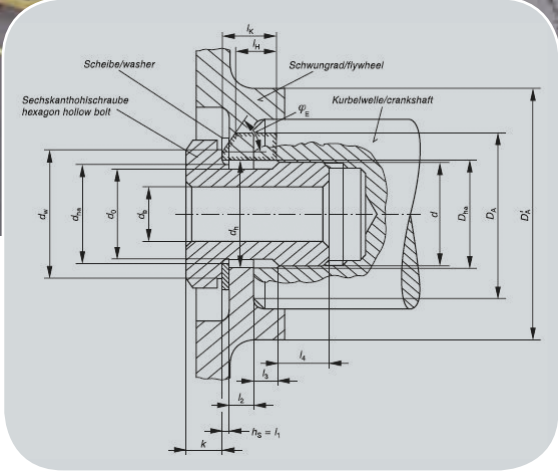
We support a leading manufacturer of gas turbines in the execution of these calculations. One of our tasks is the strength assessment according to the ASME Code. These tasks cover static strength, low cycle fatigue and fracture mechanics reviews.

Nuclear casks

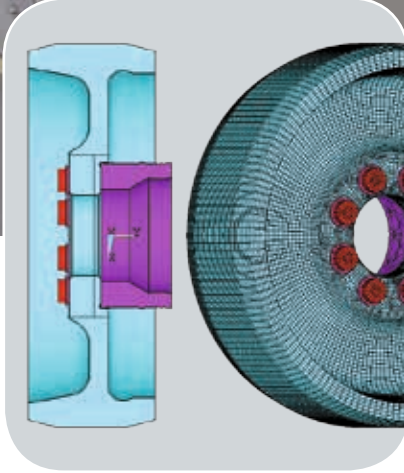
As part of the certification of casks for transport and storage of spent fuel rods, mechanical stresses of the components of the cask for operating and accident conditions have to be proved. While bolted joints or lifting lugs are designed under operating conditions, the functioning of the shock-absorbing components is verified under accident conditions, for example for a drop of the cask. The calculations extend accordingly from analytical methods to dynamic analysis models for recalculation of drop tests.

The German manufacturer of casks for transport and storage of spent fuel, we support in these calculations. Our tasks include for example:

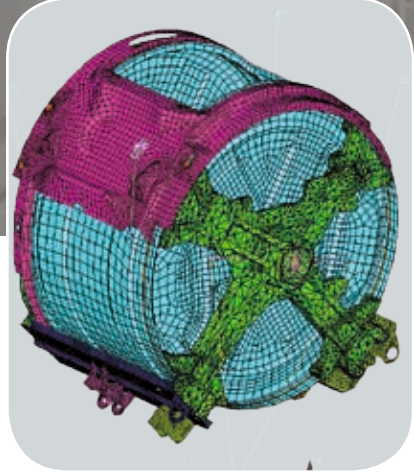
- design of bolted joints according to VDI guideline 2230 or the regulations of the KTA
- design of the lid system and the cask body, for example made of ductile cast iron
- design of the shock-absorbing components of the nuclear cask, for example made of wood, foam or aluminum
- recalculation of drop tests for verification of calculation models
- Simulation of the stability of the cask under seismic load or in the behavior of a plane crash
- Creating verifiable safety reports



Analytical Verification of a Bolted Connection



FE-model of a Bolted Connection



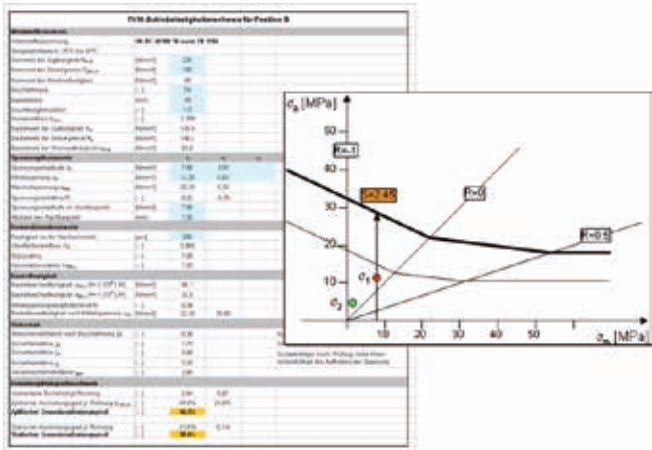
Dynamic Simulation of a Washing Machine

Mechanical Engineering

Machine components mainly have to withstand mechanical stresses. The loading is usually of dynamic and static nature. For dimensioning and strength analysis we use both, finite element programs as well as the classic analytical methods of calculation. E. g. bolted joints are typically verified according to VDI guideline 2230 by analytical methods.

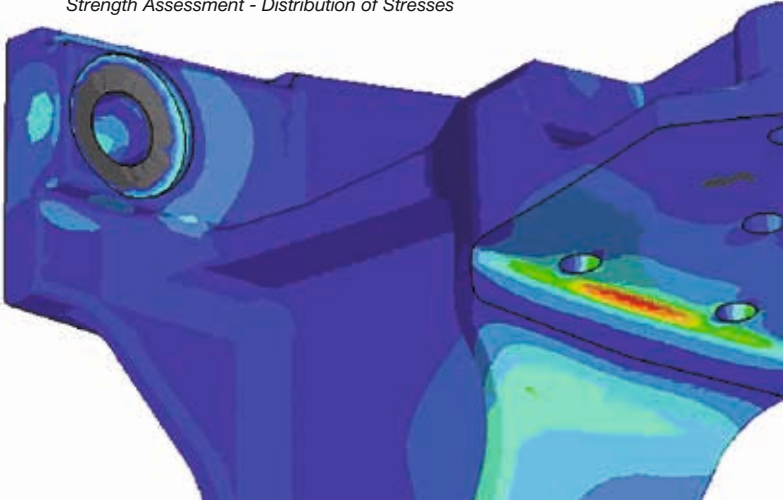
In case that component due to their complexity or the stress level no longer fulfills the conditions for the validity of such calculation rules, a detailed finite element calculation is used. We solve static problems with the FE software ANSYS. Dynamic problems usually relate to the resonance or the response due to harmonic excitation and are also solved with ANSYS.

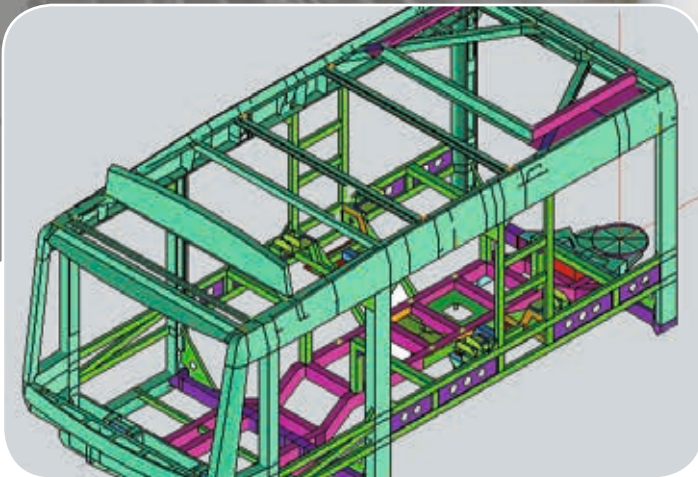
For the strength assessment of machine components the FKM guideline has established itself as the standard in recent years. We offer proofs in fatigue analysis according to FKM with the software RIFEST and self-developed tools.



Strength Assessment

Strength Assessment - Distribution of Stresses





Strength Analysis - Car Body

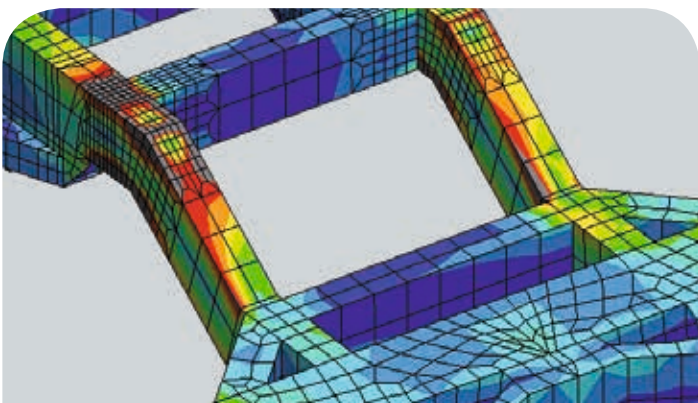
Rail vehicle engineering

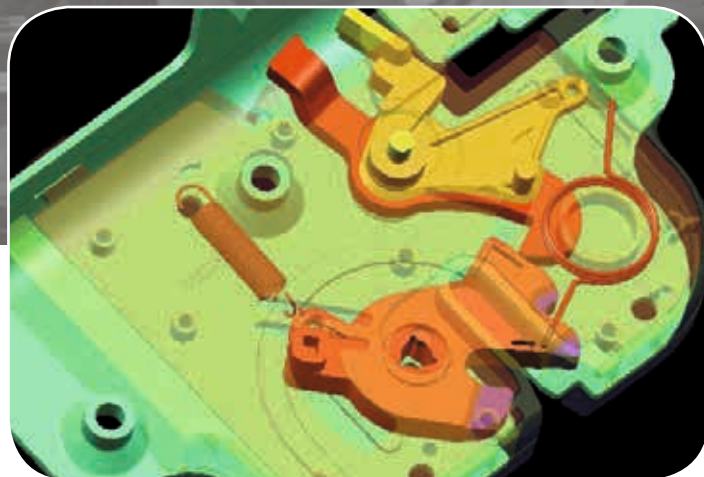
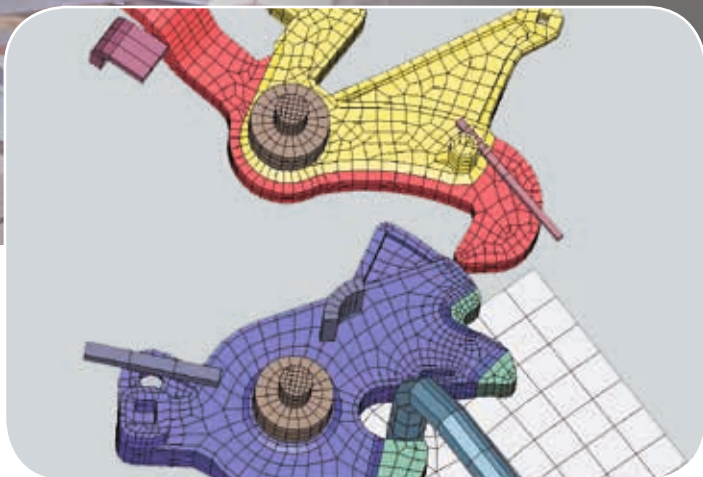
One focus of our industry expertise lies in the field of railway technology. Notable customers we support in the design of various components of the chassis and the car body. The spectrum covers proof of concept, structural design, optimization and analytical strength assessment.

Calculation models include single components, assemblies and connection elements. The fatigue assessment is done according to technical regulations like FKM guideline, Eurocode or VDI guideline 2230. The computational investigation is complemented by experimental validation. The specification, planning and implementation of fatigue tests are realized in close cooperation with testing institutes.

On this way the development of a carriage body traverse for the Chinese high-speed train Velaro CRH3 was executed in cooperation with the Swiss Alu Metall Guss AG. The approximately 3 m wide component superimposes on the carriage body to the air springs of the chassis. Knowledge of highly stressed areas of the mechanical FEM calculation in combination with the results of casting simulation enabled an improved utilization of the material properties to reducing their weight. A fatigue test was successfully done at the IMA Material Research and Application Engineering GmbH.

Strength Analysis - Distribution of Stresses





Simulation of Closing Operation of a Car Door - FE-model

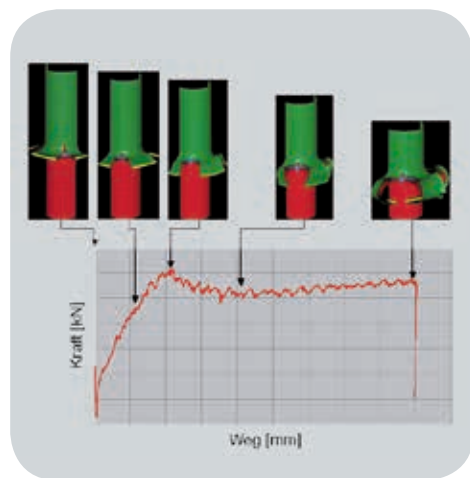
Simulation of Closing Operation of a Car Door - CAD-cinematic

Automotive

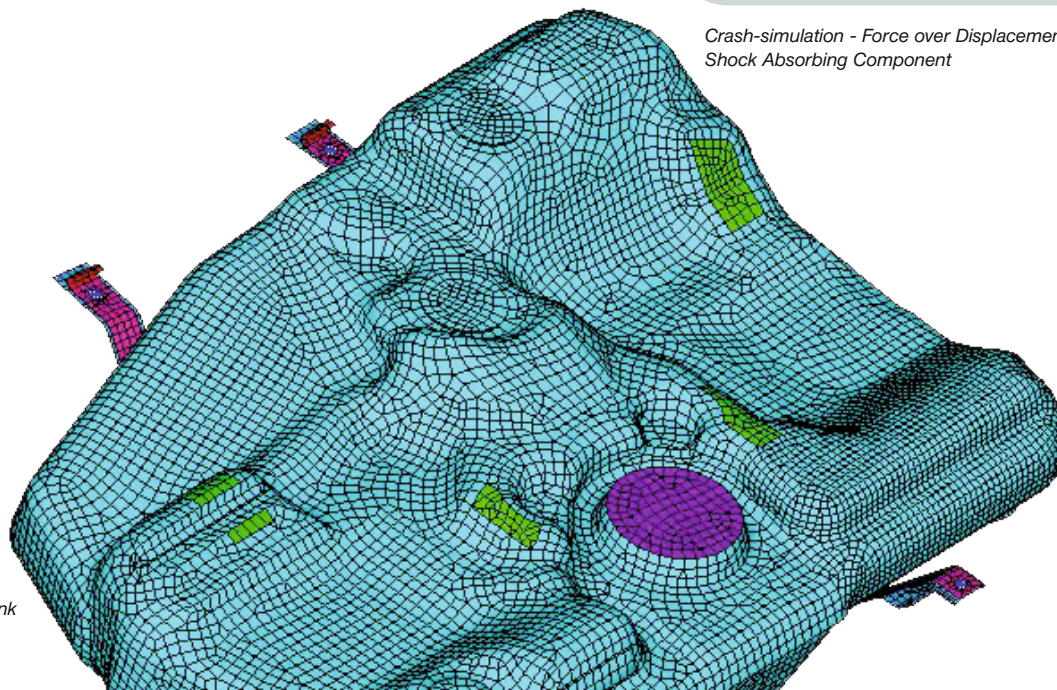
We support suppliers of the automotive industry in calculation and simulation tasks during product development.

Typical tasks are investigation of the stiffness, analysis of the dynamic response behavior or minimization of weight and behavior during crash.

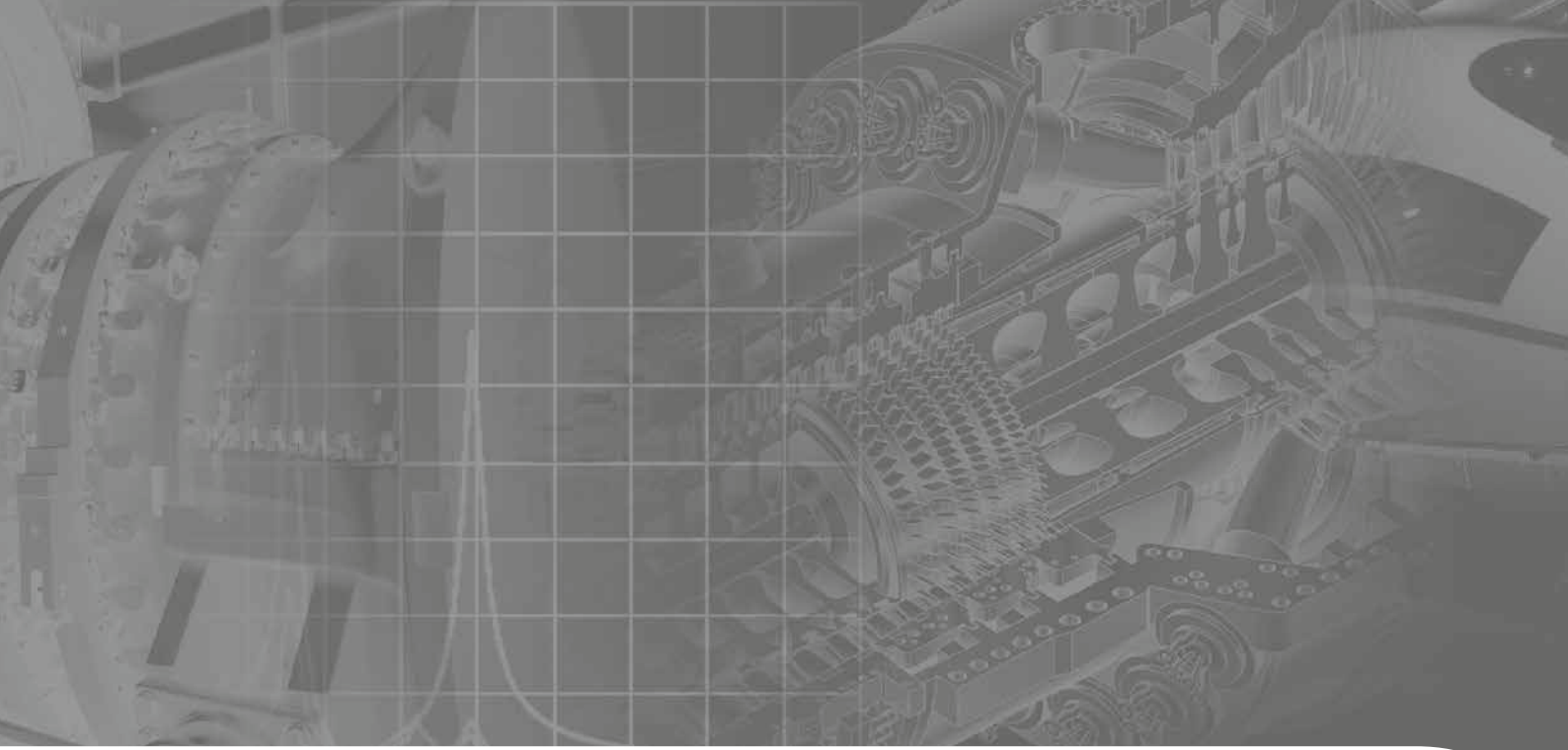
Head impacts onto components of the interior, closing operations and slam of doors are short-term actions that are solved with explicit FE-codes. We use for these tasks the program LS-DYNA



Crash-simulation - Force over Displacement of a Shock Absorbing Component



Analysis of the Stiffness of a Fuel Tank



References:

Siemens AG, Energy Sector: Figures Gas Turbines

Siemens AG, Industry Sector: Figures Rail Vehicle Engineering



Europaplatz 7
44269 Dortmund, Germany
Telephone: +49 (0) 231 94 53 65-0
Telefax: +49 (0) 231 94 53 65-11
info@itb-fem.de
www.itb-fem.de