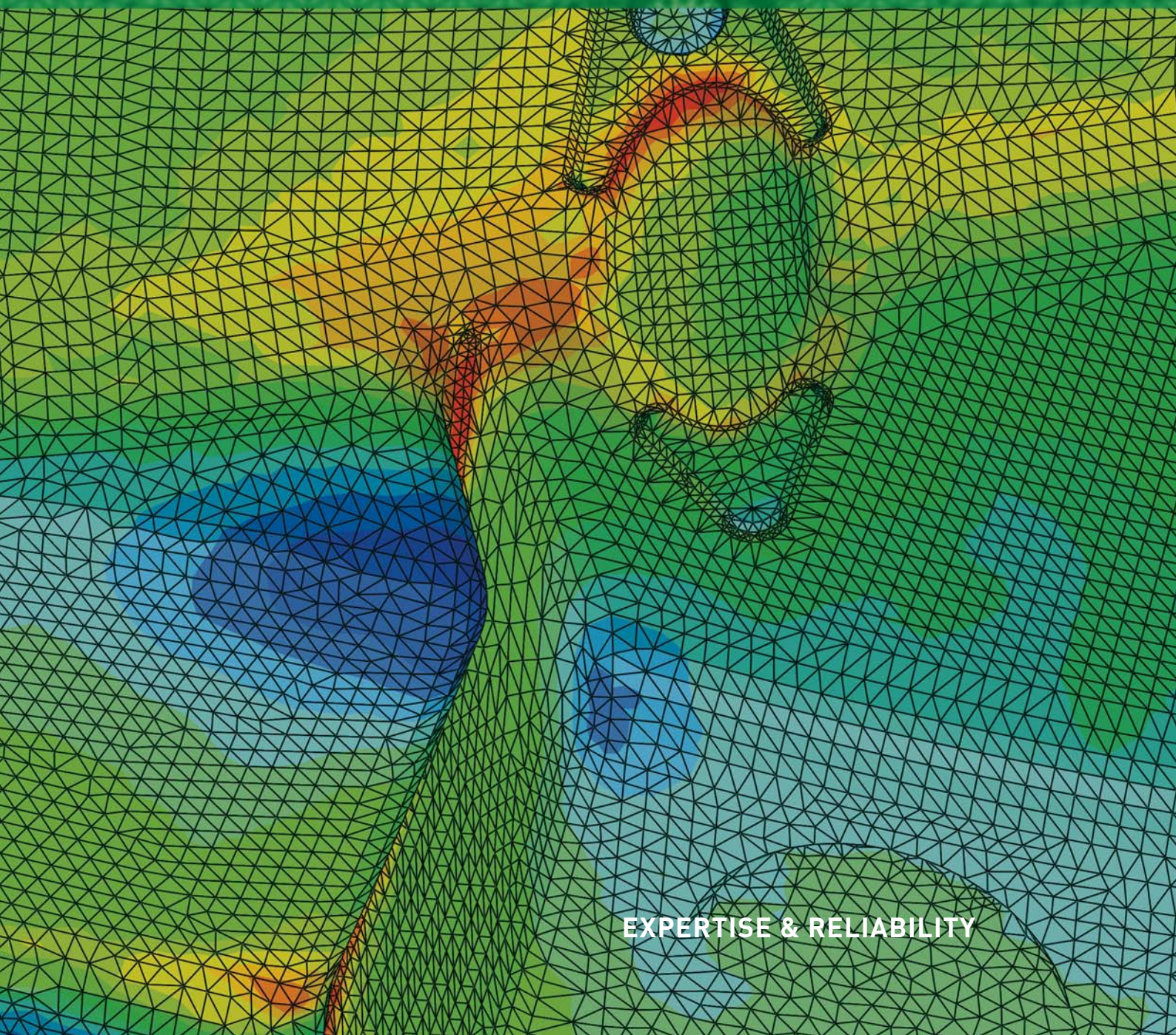


Modelling and Simulation



EXPERTISE & RELIABILITY

Modelling and Simulation

Our expertise is your benefit

The Materials Center Leoben offers a sound mix of theoretical and practical expertise and state-of-the-art facilities, making it a flexible and experienced partner for demanding research, development and application tasks in the areas of materials engineering, process engineering, quality assurance and component design.

The simulation team at MCL combines comprehensive expertise in high-quality modelling and FE simulation with longstanding experience in material behaviour and damage analysis. Special expertise exists in

- Simulation services for development and design
- Damage tolerant design
- Thermomechanical loading
- Process chain simulation
- Modelling of complex material behaviour

The simulation services offered range from simple linear problems to thermomechanical analyses to strongly non-linear models (elasto-viscoplastic material behaviour, phase transformation behaviour during heat treatment, contact, etc.).

Stress distribution under thermomechanical loading

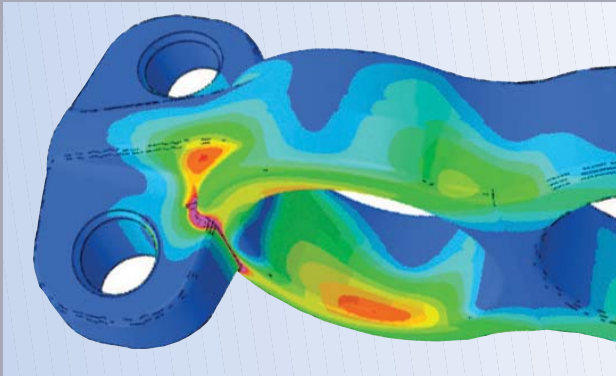
Simulation of growth rate of thermal shock cracks

EXPERTISE AND CUTTING-EDGE METHODS

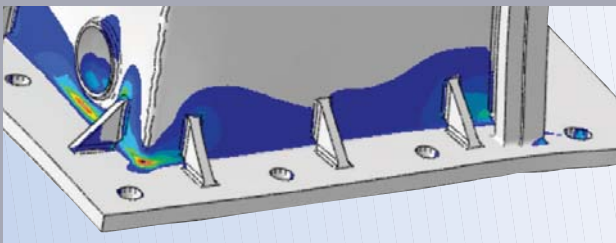
FOR YOUR SUCCESS

Stress and fracture analysis for component design

FE simulation to support the technical implementation of innovative product and design ideas.



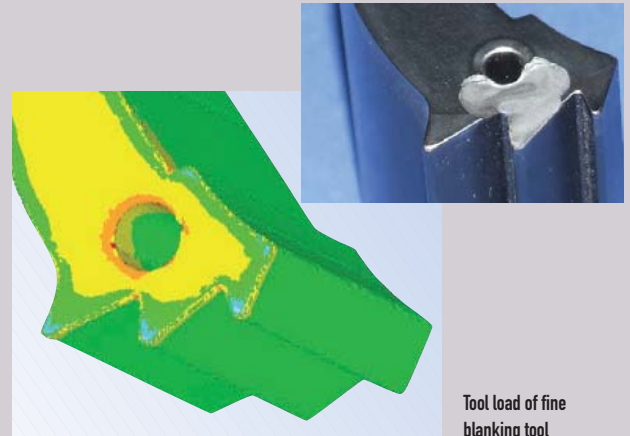
Design of chain tensioner in accordance with fracture mechanical criteria



Thermomechanical fatigue of furnace casing

Load analysis for increasing tool service life

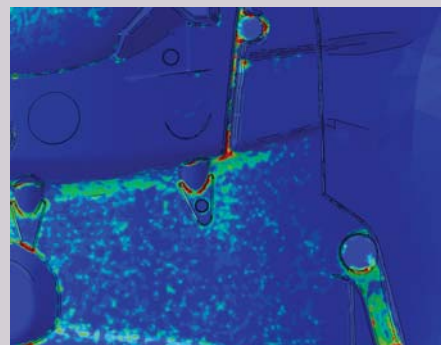
FE analysis of tools to optimise geometry, material selection and process parameters.



Tool load of fine blanking tool

Our fields of expertise

- Thermomechanical analysis of die casting molds and die holders
- Load analysis of forming tools
- Optimisation of drills and cutters
- Different tool materials (tool steels, cemented carbides, ...)



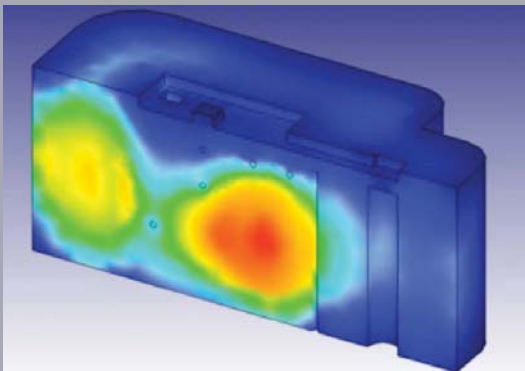
Local damage on die casting mold

Our fields of expertise

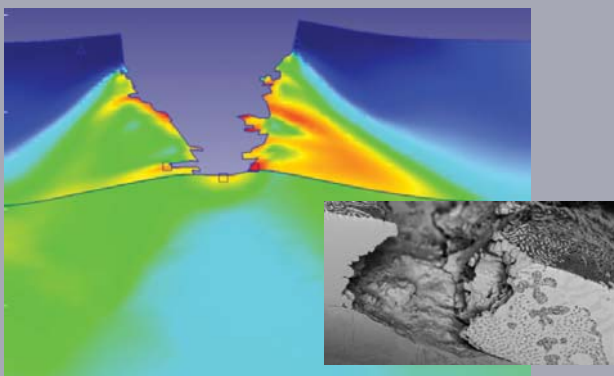
- Loading and damage analysis
- Fatigue and fatigue life analysis
- Design in conformity with standards
- Damage tolerant design / fitness for purpose
- Simulation support in component development

Simulation of materials processing

Simulation of property distributions and damage to components induced by the manufacturing process.



Heat treatment – bainite distribution in a tool



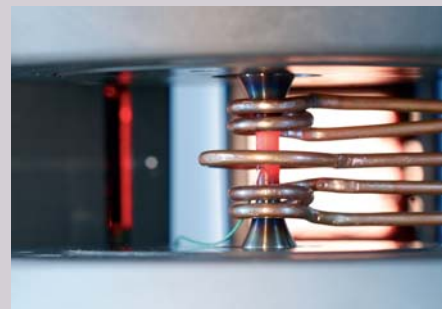
Crack formation during the bending of coated sheets due to pre-damage

Our fields of expertise

- Process chain simulation - fatigue analysis of components taking into account the manufacturing process
- Heat treatment simulation (distribution of microstructure, hardness, internal stress and distortion)
- Simulation of carburising and nitriding processes
- Assessment of damage induced by forming processes

Modelling of complex material behaviour

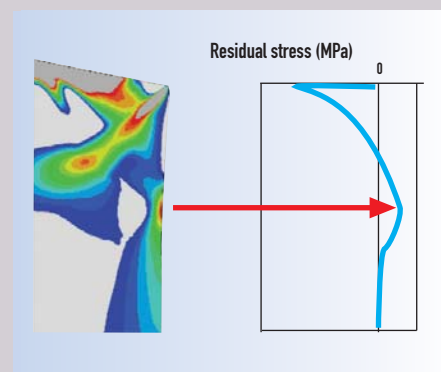
Description of inelastic material behaviour (model selection, materials testing and parameter determination) using advanced material laws. The resulting models are used to improve materials, processes and components.



Testing of material behaviour at temperatures up to approx. 700°C.

Our fields of expertise

- Selection of suitable models
- Modelling of cyclic plasticity, phase transformation and damage
- Simulation of the development and relaxation of internal stresses
- Determination of material parameters (experiments and parameter optimisation)



Development of internal stresses as a result of cyclic plasticity at a highly stressed cutting edge



Our range of services

- **Structural mechanical FE simulations** of different kinds using the Abaqus software package
- **Stress and fracture mechanical** component design for static and dynamic loads
- **Damage tolerant design** / fitness for purpose
- **Design in conformity with standards** (DIN, VDI, FKM, ASME, BS, IIV, FITNET, etc.)
- **Simulation support** in component development
- **Thermomechanical** loads
- Complex **contact problems** and contact fatigue
- FE simulations for determining **causes of damage**.
- Automated and **customised pre- and post processing** for the Abaqus software package; provision of tools (scripts & plug-ins) for customer calculations
- Simulation of **heat treatment, forming and machining processes** using the DEFORM FE software package
- **Determination of material parameters** (experiments and parameter adaptation for conventional constitutive laws)

Our expertise

The MCL simulation team of over 30 highly qualified experts provides both research and simulation services.

The expertise of the members of our simulation team is highly sought after in a **variety of sectors**

- Automotive engineering
- Mechanical engineering
- Metal production
- Metal processing
- Electronics
- Medical engineering

and includes a **wide range of materials**

- Metals
- Cemented carbides
- Plastics
- Composites
- Structural and functional ceramics

The MCL experts not only solve sophisticated modelling and simulation tasks, but also **interpret and assess the simulation results** based on their excellent expertise in the fields of material behaviour, fracture mechanics and damage analysis.

The simulation results provide the basis for developing **suggestions to improve and optimise the design, material selection and manufacturing process** in cooperation with the customer.

Modelling and Simulation

Materials Center Leoben
Forschung GmbH
Roseggerstraße 12
8700 Leoben
Austria

T +43-3842-45922
F +43-3842-45922-5

simulation@mcl.at
www.mcl.at