ZKL GROUP

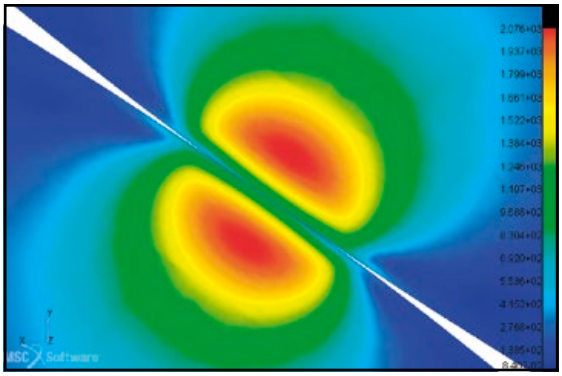
Research and Development

Where know-how meets experience

ENGINEERING

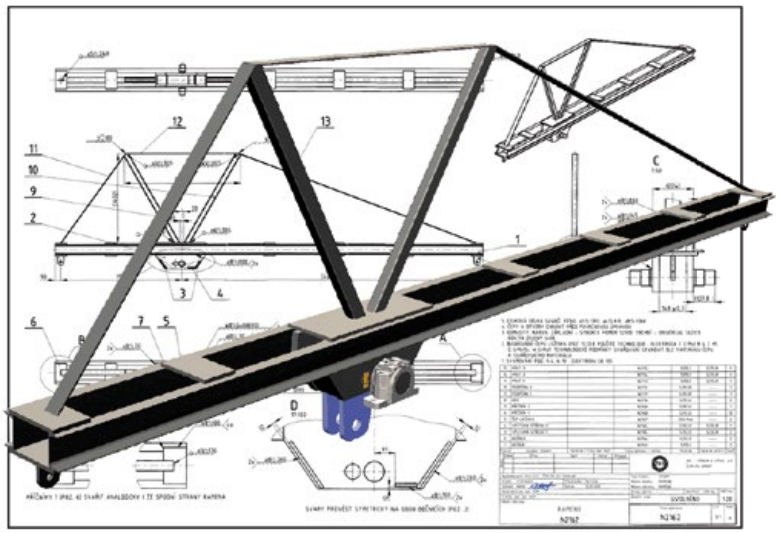
Research and Development Activities

- proposal and development of the design concept
- dimensional proposal
- conceptual study
- FEM analysis
- design optimization based on FEM analysis and calculations
- sensitivity analysis
- expert reviews
- cooperation with universities and research centres – contact mechanics, tribology, material engineering



Detailed Design of Machine Units and Single Parts

- detailed drawing of assemblies and single parts
- drawings creation from 3D model
- design and verification calculations



Technical Calculation and Analysis

- verification and optimization of bearing design and technological parts for their production
- calculations for external customers in general mechanical engineering
  - analytical calculations
  - Finite Element Methods calculations

Finite Element Method Simulations – FEM

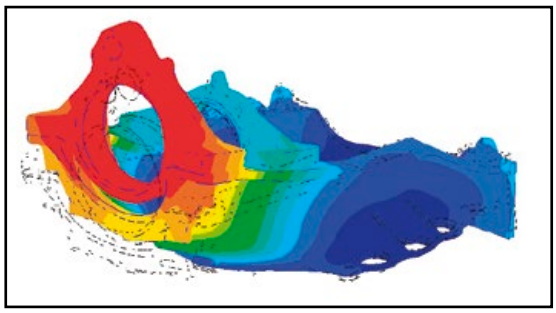
- modern, highly advanced mathematical method used in the development in machine parts
- safe the cost of prototype testing
- suitable for calculation involving the multiple impact of loads (metaphysical tasks)
- goal of the method is assessment of weak point of design

Examples of Finite Element Method Simulations

- structural analyses
- stiffness analyses
- behaviour of bearings in subassemblies
- mechanical stress at higher temperature

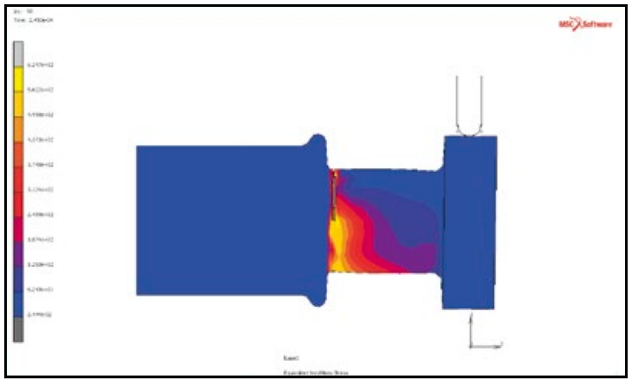
Structural Analyses

- with linear material model
- with non-linear material model
- geometrically linear
- geometrically non-linear
- contact problems
- tasks with combined loading



Dynamic Analyses

- modal analyses (natural frequencies)
- frequency response on harmonic excitation
- transient analysis
- analysis of fracture

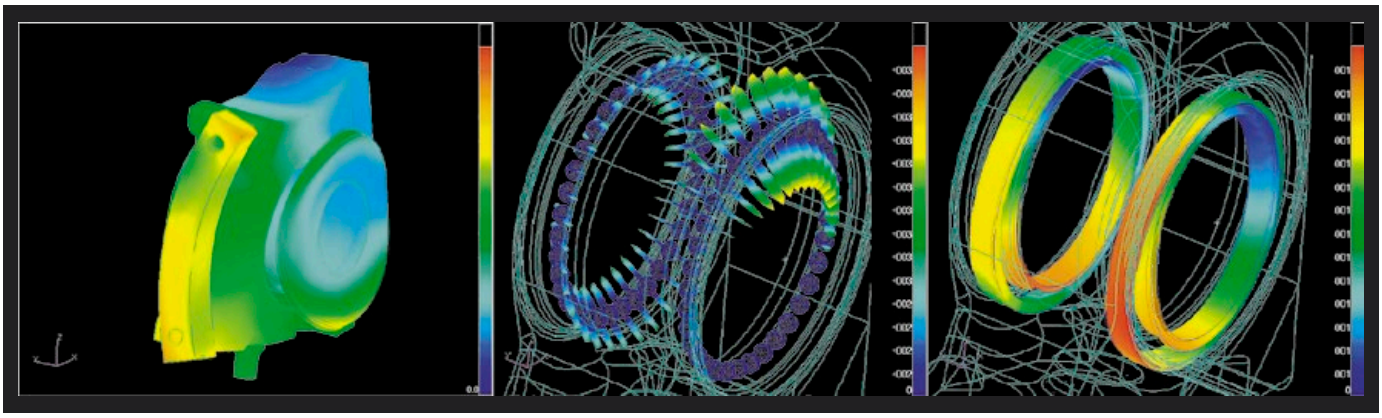


Bearing Analyses

- stress – strain analyses
- stiffness calculation
- determination of the reaction moment in bearing
- optimization of the internal geometry
- determination of the limit misalignment
- optimization of the bearing arrangement

Software

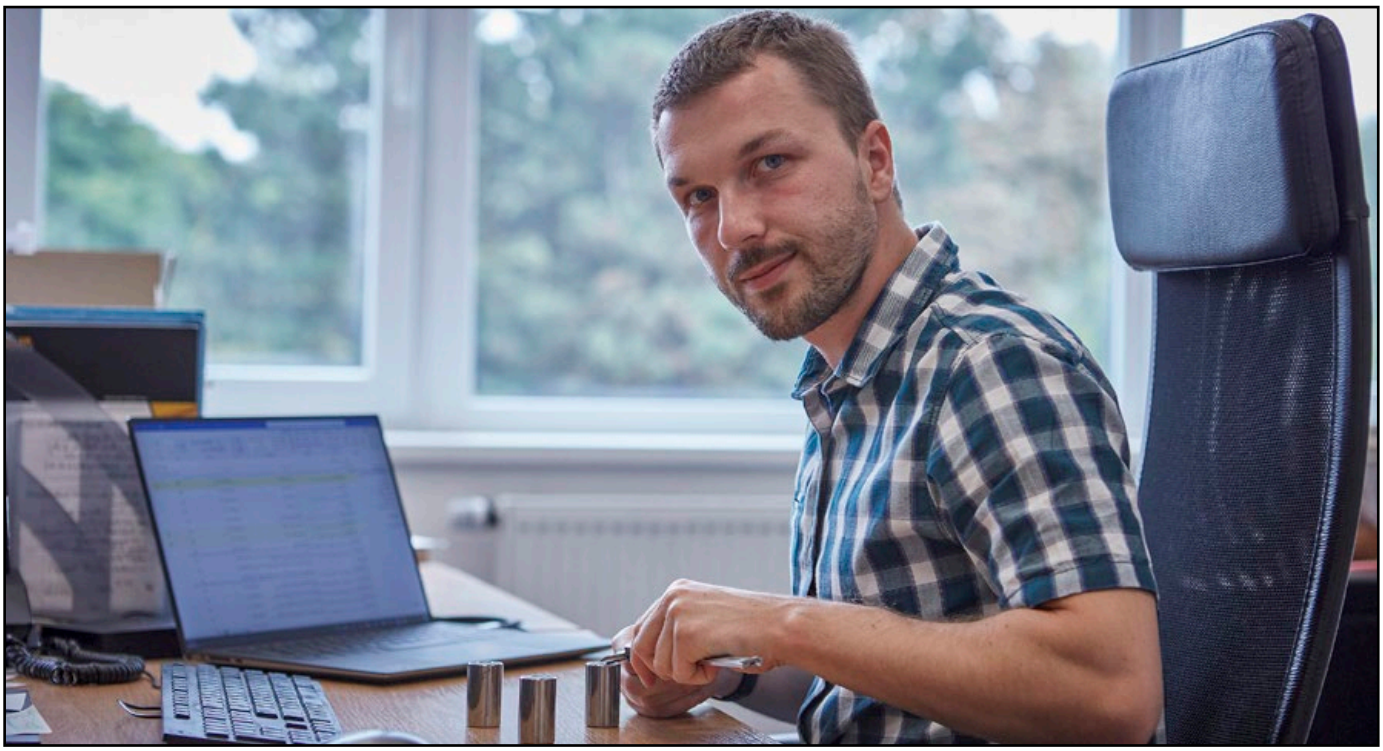
- PTC Windchill
- PTC Creo
- MSC.Patran & MSC.Marc



APPLICATION ENGINEERING

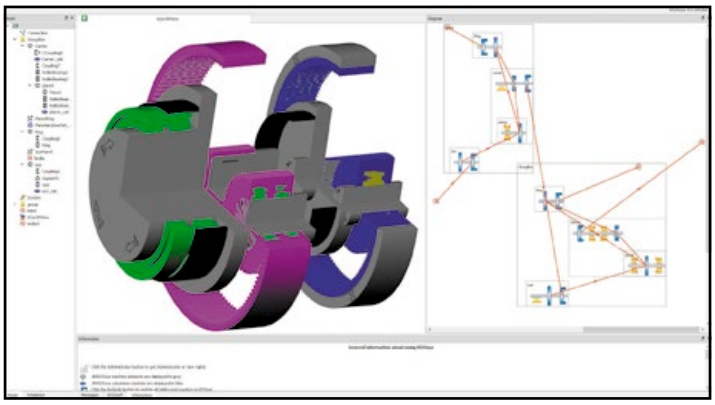
We provide technical consulting services to customers in the following areas:

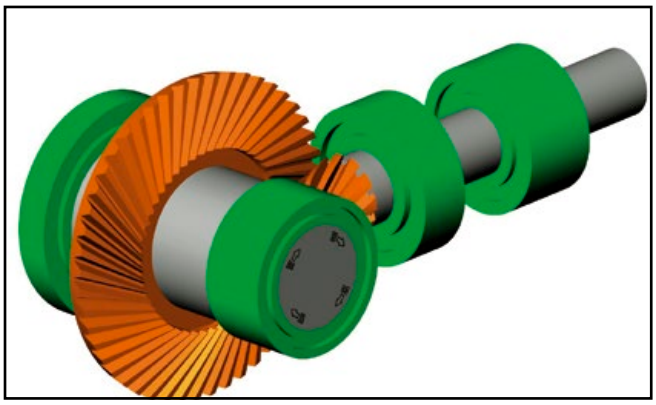
- technical consultations by phone or e-mail
- bearings selection and bearing arrangements
- bearing calculations
- proposal of suitable bearing lubrication
- customer problem analysis and proposal of corrective actions
- bearing mounting
- preparation of bearing offer drawings
- customer solutions – large-scale and specialized bearings
- technical and product training for OEM customers and distributors



Bearing Calculations

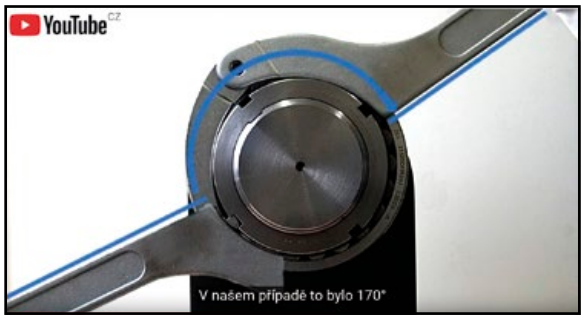
- bearing lifetime calculations according to ISO 281 and ISO TS 16281
  - single bearings without deformation consideration
  - bearings in machine units with consideration of housing and shaft deformation
- selection of bearing fits (shaft and housing tolerances)
- based on the calculation type following parameters are to be considered:
  - internal bearing geometry
  - type of lubricant, contamination level, lubrication method
  - temperature gradient inside the bearing
- calculations are made using software KissSoft and internal ZKL calculation software (created based on the ZKL know-how)





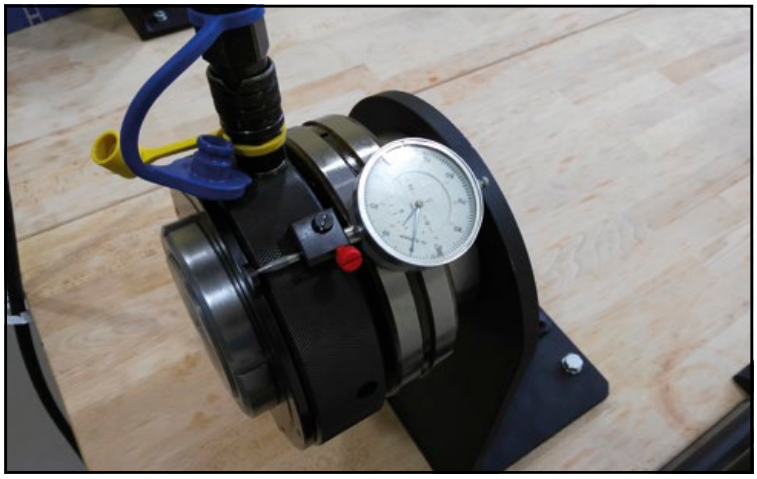
Bearing Mounting

- recommendation of suitable mounting and dismounting methods
- creation of mounting manuals
  – split bearings
  – railway axle bearings
  – bearings for special applications
- supervision during bearing mounting
- examples of various bearing mounting and dismounting methods on ZKL YouTube channel



Technical and Product Trainings

- trainings are performed either in the ZKL training room or directly at the customer site
- possibility of training customization according to customer requirements
- various training topics
  – general training (bearing types, bearing designation, typical bearing arrangements)
  – product training (detailed information of various ZKL bearing types)
  – technical training (bearing calculations, bearing lubrication, bearing failure)
  – practical training (mounting / dismounting bearings)



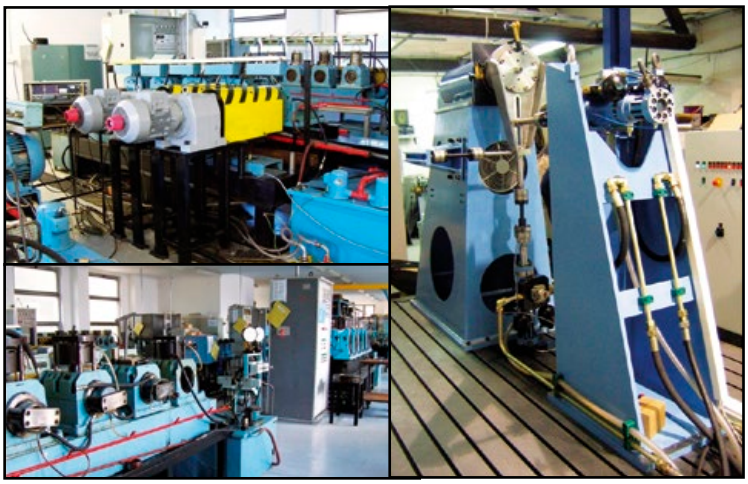
TESTING

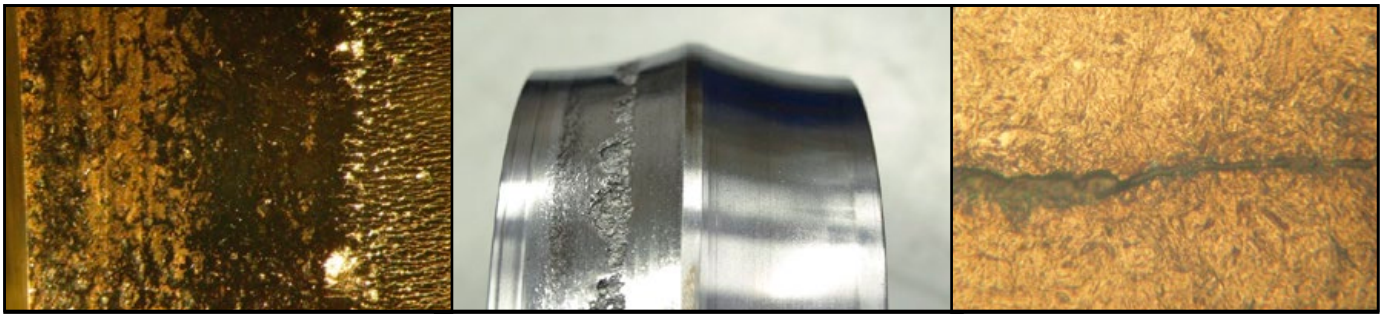
Performance Tests

- bearing dynamic load rate testing according to ISO 281
- bearing static load rate testing according to ISO 76
- bearing limiting speed testing
- testing of sealed bearings
- material fatigue testing
- temperature monitoring by thermal camera
- special test according to customer requests

Material Tests

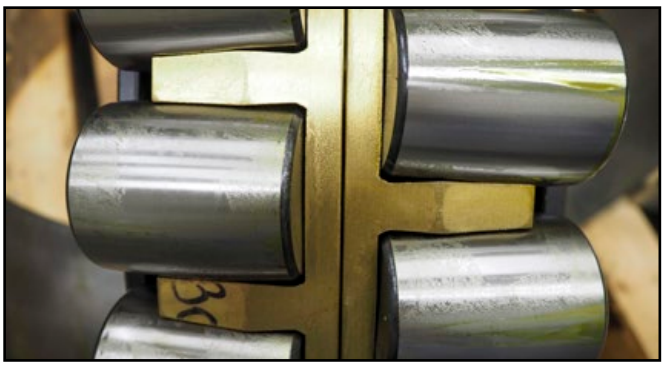
- chemical composition
- hardness testing
- inclusions (micropurity) according to DIN 50602
- carbide ratio in material according to SEP 1520
- microstructure of material





Bearing Remanufacturing

- inspection of bearing condition after planned replacement in the machine
- evaluation of suitability for continued use
- refurbishment of railway bearings



Geometrical Measurements

- complex measurement on 3D measuring machine
- length measurement
- roundness and waviness measurement
- surface roughness measurement
- surface profile measurement
- special bearing measurements
  – measurement of bearing vibration level
  – measurement of bearing residual magnetism

3D Optical Digitization and Quality Control

- measurement of complex or deformable parts
- optical method where contact method would affect the result

Electron Microscopy and Elemental Analysis

- analysis of micro and nanostructures of materials
- inspection of both metallic and non-metallic materials
- analysis of chemical composition of samples, inclusions
- combination of SE, BSE, and EDS sensors

Bearing Failure Analysis

Premature bearing failure in application is most often caused by:

- improper bearing mounting process
- inadequate lubrication
- ingress of dirt into the bearing

In ZKL, we are able to determine the probable cause of premature bearing failure based on the bearing failure analysis and type of the bearing failure. Subsequently we can recommend corrective actions to avoid repeating of the problem and thus increase bearing service life in the application.

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