EES GEAR

THE INDEPENDENT AUTHORITY IN GEAR DESIGN

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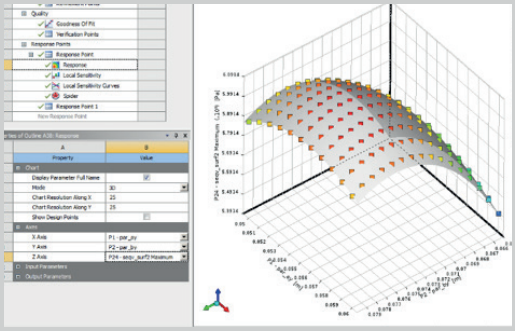
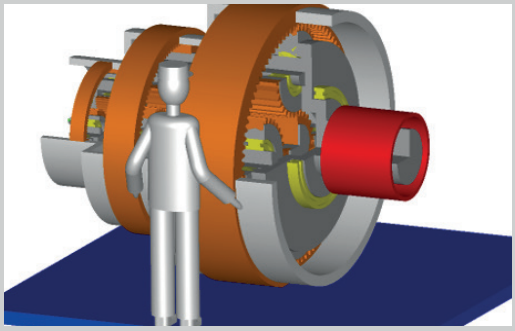
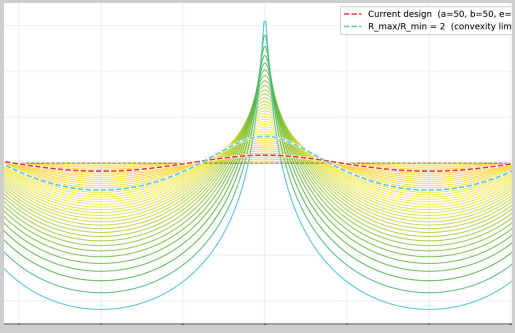
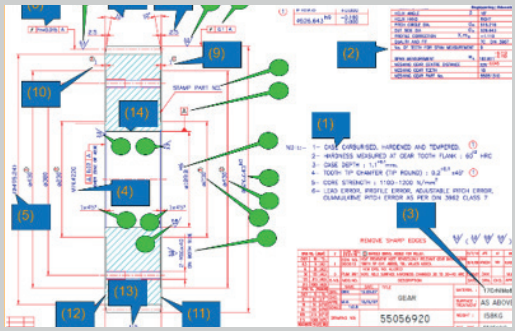








Value proposition

Clients deserve honest, specific and qualified advice.

EES Gear GmbH's (EES) goal is to make clients understand the problem and the solution so well, that they no longer need EES. That is why they come back!

Know-how transfer, comprehensive documentation and IP ownership are integral to every collaboration with EES.

In every project, EES explains findings, describes the methods and evaluates limitations transparently.

What is understood has value.

Initial customer requests are sometimes imprecise. A clear description of objectives, complete specifications, or a finalized work package description are often impossible prior to a project or even at its start.

Getting to the right questions and honing in on a suitable scope of work is central to EES expertise and part of the service!

With experience from 1 mm plastic gears to 3.5 m bearings, from 1 day design reviews to year long development work, EES knows what to ask, when to challenge and when to move ahead at full speed.

Clients trust EES to deliver clarity.

"... Dear Hanspeter ... your renowned prestige, expertise, and market knowledge promise great success in this new stage of real-life projects. Our team looks forward to continuing to collaborate on engineering solutions..."

José Luis Pina, Estudio Pina, Argentina

Industries and Expertise

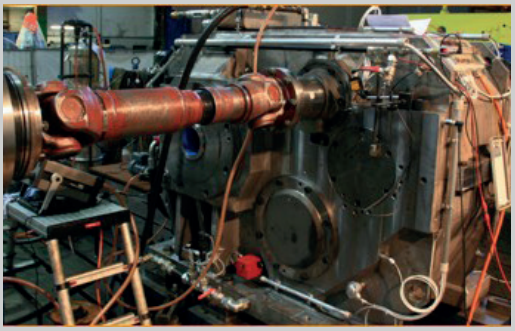
Work with EES for
- Gearbox concepts, specifications, designs
- Gear and bearing technology
- Technology surveys, patent studies
- Detailed gear, bearing and system optimizations
- Certification assistance
- Sourcing and quality control assistance
- Gearbox assembly supervision
- Components and gearbox testing
- Failure analysis, dispute assistance

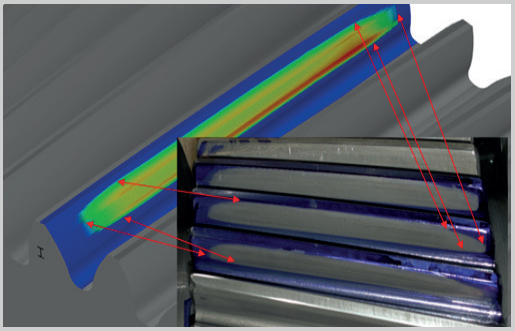
These industries request EES services
- Wind main-, pitch-, yaw gearboxes, slewing bearings
- Mill drives, winches and cranes
- Aerospace gears and gearboxes
- Roller and slewing bearing manufacturers and users
- Industrial gearing, actuators and geared motors
- On- and off-road vehicle transmissions, axles and engine gear trains
- Plastic gears, actuators, gearheads

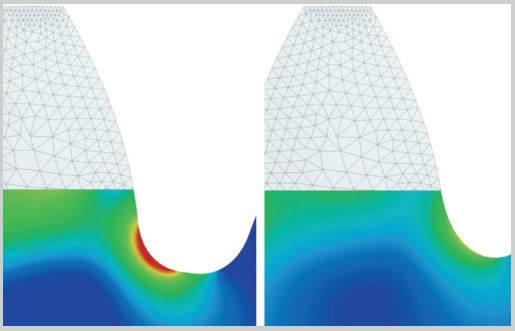
For specific works, EES partners with
- INGENIS AG, Switzerland, for FEM works
- GEARLAB, Switzerland, for dynamic analysis
- MESYS AG, Switzerland, bearing and flexible geared systems analysis
- MB BEARING SOLUTIONS GmbH, Germany, for bearing selection, failure analysis, metallurgy
- ZHAW, Switzerland, gear testing and test rig design
- LONGATO RICCARDO Srls, Italy, plastic gear testing
- BAUHAR, Slovenia, plastic gear optimization
- NEXTGEN GEARS Pvt., Ltd., India, design, CAD works
- ANSOL, USA / Italy, for transmission analysis

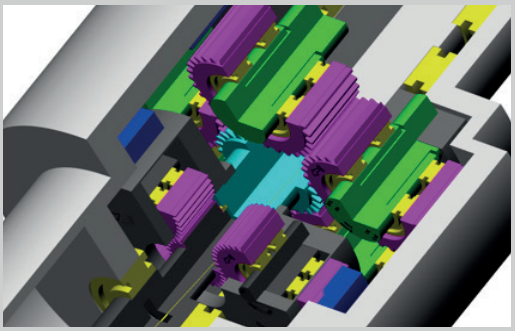
"... Hanspeter, thanks for the enjoyable and valuable collaboration on the Flexpin project and the planetary gear recalculation. Your industry experience, practical insights, and constructive input are greatly appreciated..."

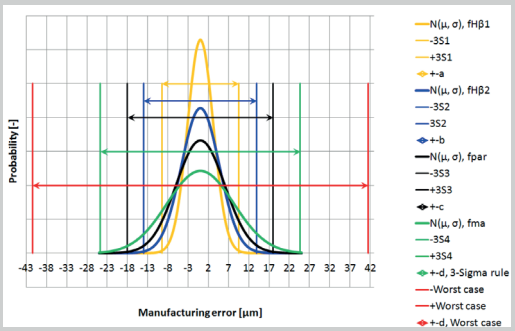
Michael von Ow, CTO, Kissling AG

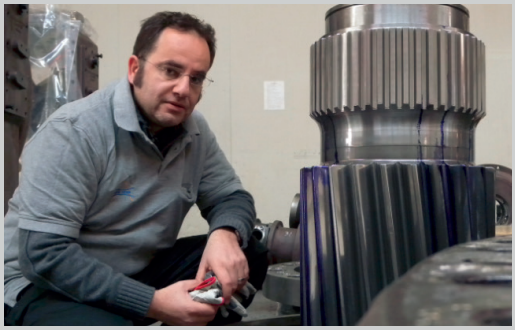


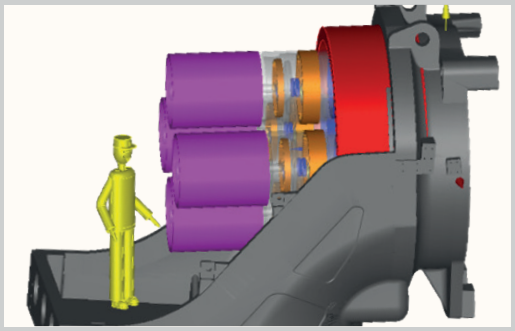












Projects Experience: Wind Industry

Main gearbox, 3 MW class, Spain
- Planet gear root optimization
- Development and definition of methods
- FEM based, ISO 6336 based

Main gearbox, 5 MW class, Spain
- Assessment of tooth flank fracture failure
- Supporting gearbox purchaser in a dispute
- Analysis and critique of argumentation

Main gearbox, 4 MW class, Germany
- Condition assessment after trial, damage analysis
- Recommended repairs, re-design, replacement parts

Main gearbox, 3 MW class, Germany
- Assembly supervision
- Test witnessing and reporting
- Load distribution measurement

Main gearbox, 3 MW class, Germany, Japan
- Modification of bearing concept to accommodate for axial accelerations of floating turbine

Main gearbox, 3 MW class, Spain
- Design and engineering analysis review
- Test witnessing, assessment at supplier site in China
- Gear modifications optimization

Main bearing, 3 MW drive train, Germany
- Supplier calculation review and guidance

Training on engineering analysis, Spain
- Gear and software training
- On site, several days, group of engineers

Drive train, 3 MW class, Switzerland, Croatia, France
- Drive-train conceptual design, cost, feasibility analysis

Main gearbox, 660 kW class, Germany
- Re-design, FEM analysis, testing, certification

"... Sometimes, getting the certificate for a new product is difficult due to the technical requirements and also because of the deep technical discussions required with the certification agency. ... we are happy to outsource to EES Gear GmbH ..."

Mr. Chang-kyu Shin, Haisung Good Three Co., Ltd., Korea

Projects Experience: Wind Industry

Main gearbox, 4 MW class, Germany
- Design review of low cost, light weight gearbox
- Gears, bearings, shafts, connections rating

Main gearbox, 6 MW class, Germany, China
- Design, gear technology, Flexpin technology
- Engineering analysis, FEM, part drawings, part lists
- Assembly and test supervision, sensor specifications

Main gearbox, 8 MW class, Germany
- Conceptual and overall design, engineering analysis

Slewing bearings, 5.5 MW class, Korea
- Bearing rating for certification, static and fatigue rating
- Certification assistance

Pitch, yaw gearboxes, 1, 2, 3, 5 MW class, Korea
- Gears, bearings, FEM rating for certification
- Certification assistance

Main gearbox, 3 MW class, Spain, China
- Design and engineering analysis review
- Test witnessing and assessment at supplier site

Main gearbox, 2 MW class, Austria, China
- Design and engineering analysis review
- Test witnessing and assessment at supplier site

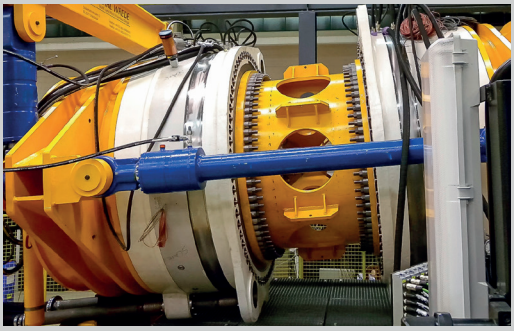
Main gearbox 3 MW class, Germany, China
- Design review, calculation review

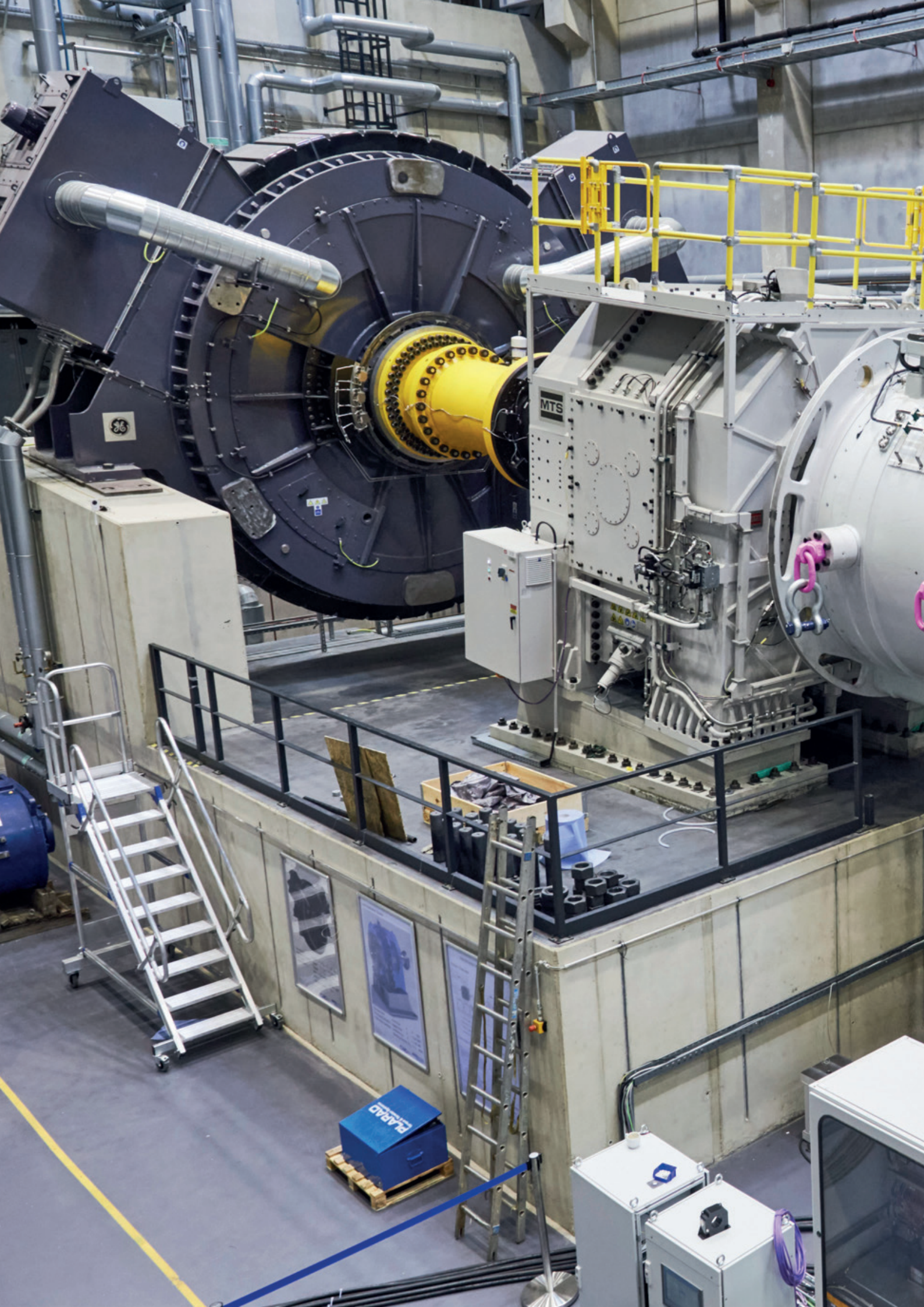
Main gearbox, 1 MW class, India
- Engineering analysis for certification
- FEM analysis, thermal rating, gear modifications

Main gearbox, 1.6 MW class, India
- Conceptual design, gear and bearing definition
- Gear detail design, modifications, LTCA

"... Hello Mr. Dinner, all test with new gear corrections until now have shown vibration level reduction.
Best regards, Jose-Luis Roman ..."

Jose-Luis Roman, Mechanical Design, Alstom Wind, Spain

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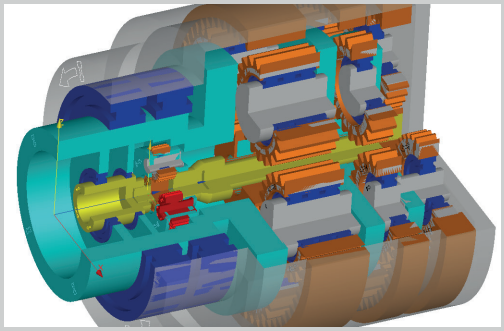
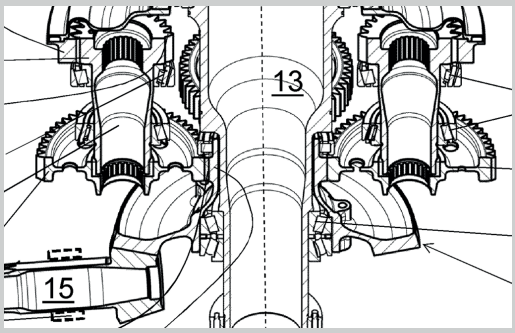
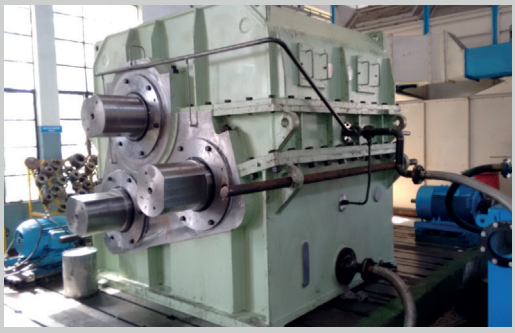
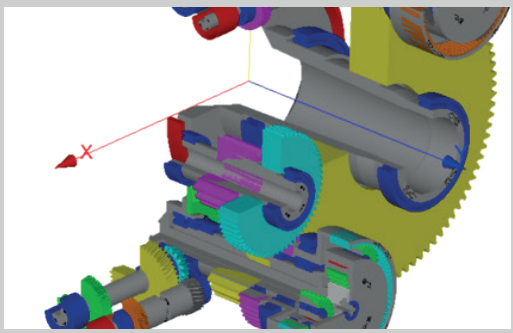








Projects Experience: Industrial, Aerospace

UAV gearboxes, UK
- Planetary gears for multi-rotor UAV
- Low weight, high reliability, compact design

Cement mill gearbox, India
- Overall design and rating
- Gear modifications
- Installation and commissioning assistance

Planetary gearbox, four stage, Italy
- Failure investigation
- Gear optimization, system deformation analysis

Helicopter MGB and TGB, Switzerland
- Concepts comparison
- Rating for EASA certification
- Gear modifications

Vertical roller mill gearbox, France
- Concepts comparison, gear modifications

Plastic gear based actuator, China
- Tooth form optimization
- Strength rating for elevated temperature

Bevel-helical gearbox for mining, Germany
- Gear modifications
- Final strength rating with load spectrum

Crane planetary gearbox, China, Finland
- Overall design, components rating, gear detail design

Bucket wheel excavator, two speed gearbox, Germany
- Gear and bearing rating and optimization

Aerospace actuator gearboxes, China
- Material selection for low and high temperature, vacuum, manufacturing drawings, tolerance analysis
- FEM, gear and bearing rating, lubrication

"... We like your work very much, it will help us in our discussion with the customer. We like not only the technical result but also how you explain it and the reports are easy to understand..."

Giovanni Patini, Dinamic Oil S.p.A, Italy

Projects Experience: Bearings

Pitch and yaw bearing assessment, Germany
- Supplier assessment, engineering analysis review

Main bearing assessment, Germany
- Supplier assessment, engineering analysis review

Slewing bearing, 5.5MW turbine, Korea
- Static, life and stress rating, hardness depth
- For DNVGL certification

Investigation of wear effects, Spain
- Slewing gears for wind turbines, gear optimization

Gearbox and main shaft bearings, Germany
- 1.6MW wind gearbox with integrated main shaft
- For bearing OEM

Calculation for certification, Germany
- GL certification for four gearboxes
- For a bearing supplier

Calculation of pitch bearing, China
- Calculation along NREL DG 03

Re-calculation of main bearing, India, Japan
- Direct drive wind turbine, supplier analysis assessment

Analysis of a >5m slewing bearing, Korea
- Ship unloader application
- FEM calculation combined with ISO16281

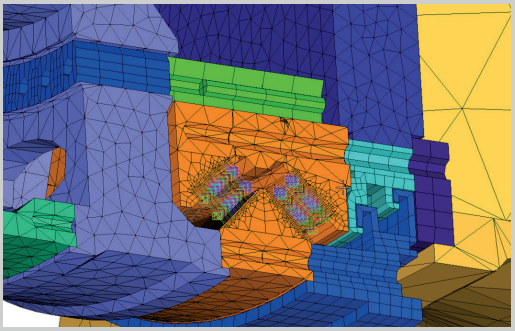
Re-calculation for certification, India, Italy
- Wind turbine pitch/yaw bearing, supplier assessment

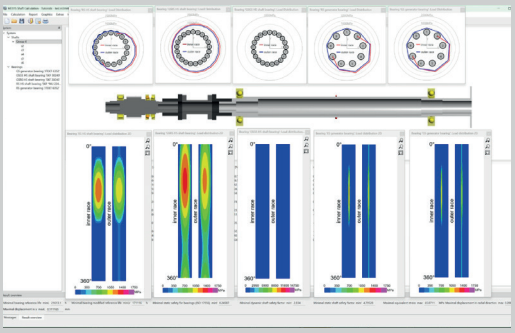
Analysis review India, Korea
- Certification assistance of pitch/yaw bearing

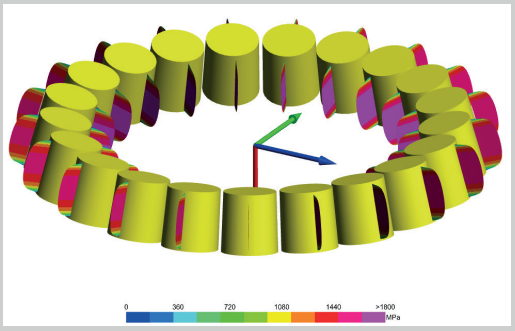
Comparative analysis, Germany
- For wind turbine pitch and yaw bearings
- For different suppliers with unified approach

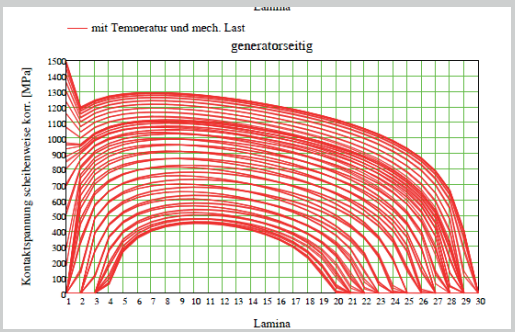
"...Thanks to our engineer team being assisted by EES Gear GmbH, we were able to complete this project on time and were able to confirm optimal contact patterns in the gears during test, as predicted by EES to deliver the best in class product to our customer ..."

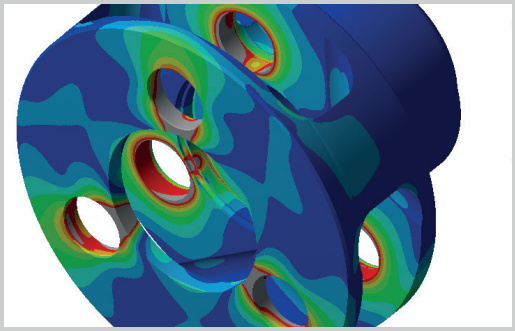
N. D. Kulkarni, General Manager, Premium, India

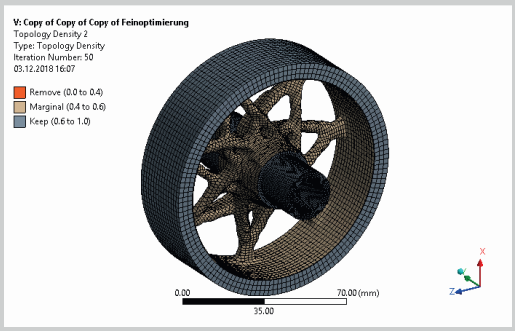


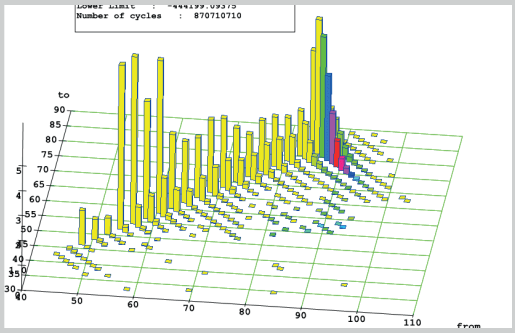


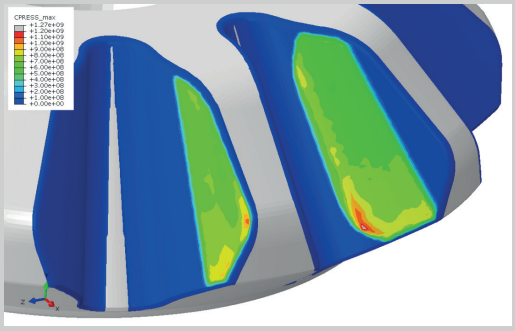


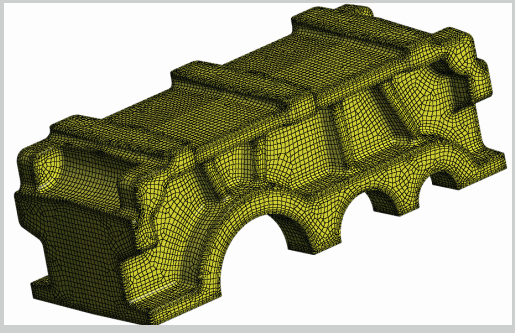


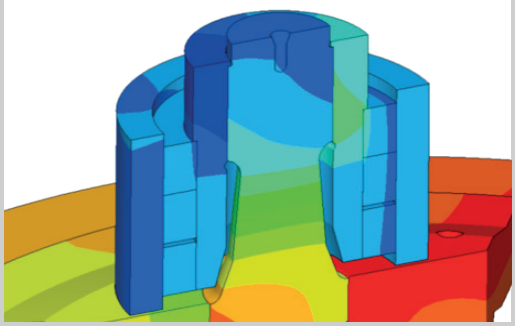












Projects Experience: Finite Element Analysis

Parallel shaft wind gearbox housing, Germany
- Welded housing, static and fatigue rating
- Considering main shaft, bearing and bolt forces

Flexpin analysis, Germany
- Fatigue verification with time series
- Stiffness optimization
- Geometry variants comparison

Planetary carrier fatigue rating, India
- For 1MW wind turbine gearbox
- For certification along GL guideline

Complete wind turbine drive train, deformation, Germany
- Including DRTRB stiffness, influence of main bearing deformation on LSS planetary stage
- Simulation of assembly through bolt pretension
- Consideration of thermal expansion of parts

Housing, worm gearbox, India
- Stress distribution and strength assessment

Forged bevel gears for differential, China
- Contact stress calculation for whole meshing cycle
- Using ABAQUS for contact analysis
- To refine KISSsoft LTCA

Planetary gearbox, load distribution, Germany
- Calculation of Kγ with random manufacturing errors
- Using FEM model controlled by scripts
- Spring-gap model for gear contact between sun and planets, planets and ring gear

Rating for certification, pitch and yaw drives, Korea
- Static, fatigue strength of housing, carriers
- GL approval for certification

Topology optimization, aerospace gear, Korea
- Lightweight gear body design with ANSYS
- Planet carrier topology optimization

"... Thank you for the training it was very interesting for all of us. You have been very clear, you have touched interesting topics and I really appreciate the rigorous approach in the exposition and in the resolution of the problems ..."

Mr. Cividino, Chief Engineer, PMP PRO-MEC S.p.A, Italy

Projects Experience: Failure Analysis

Wind gearbox, 3 MW class, Germany, Spain
- Vibration due to unsuitable planet gear modifications
- Occurrence of micropitting
- Re-design of gear modifications

Power plant gearbox, Switzerland
- Turbo planetary gear vibration and subsequent failure
- Supporting client in his dispute with gearbox supplier

Tunnel boring machine, Switzerland
- Winch gear failure and subsequent equipment fire
- Providing insights and arguments to client for a dispute with winch supplier

Tracked vehicle drive, Italy
- Four stages planetary gearbox, system analysis
- Support in a dispute

Industrial gearbox, extruder, India
- Shaft breakage assessment and calculation

Jack up gearbox, oil platform, Norway
- Planet carrier wear due to axial displacement of planet
- Bearing clearance, tolerances, material and design

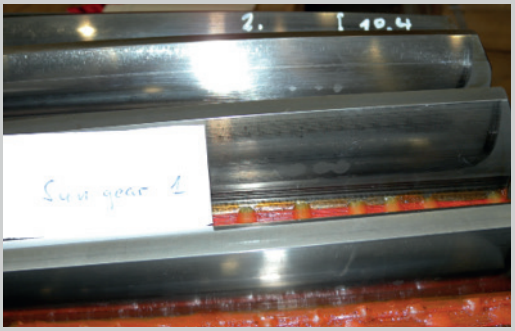
Wind turbine gearbox, 5 MW class, Spain
- Tooth flank fracture, review, assessment of supplier analysis and report

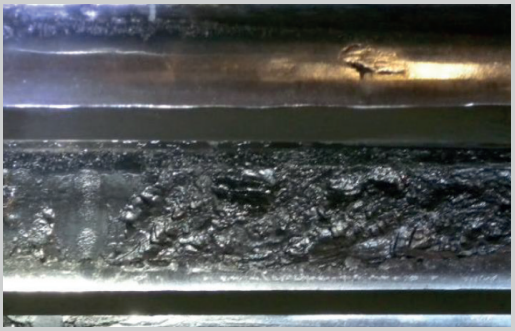
Wind turbine gearbox 2 MW class, Germany
- Assessment of gears pitting, edge loading and wear

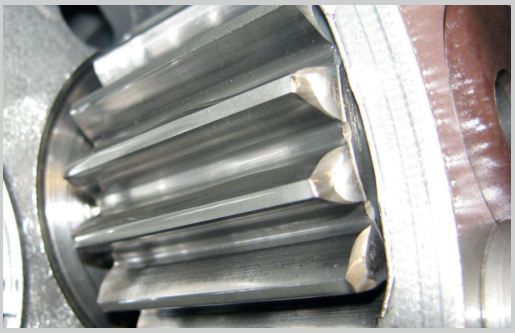
To avoid failures, EES offers
- Design FMEA, design reviews, drawing reviews
- Engineering analysis review
- Assembly instructions, manuals and supervision
- Final inspection and documentation
- Inspection after testing or after operation
- Certification and sourcing assistance

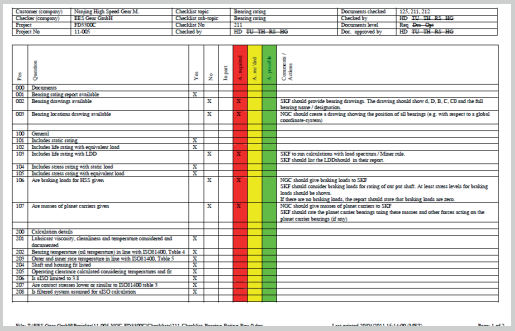
"... Dear Mr Dinner, all the best wishes from my side for your next professional experience !! I' m sure you will be successful, as usual ! ... Many, many of us, people spending time around gears, have to thank you ..."

Enzo Cognini, R&D Freelancer, Italy

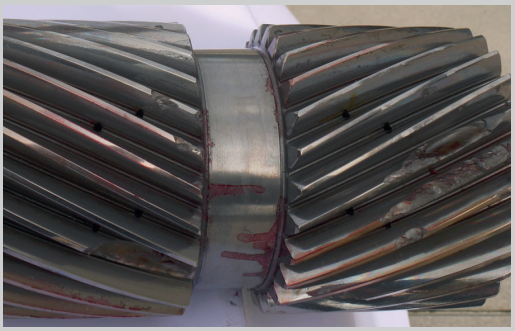


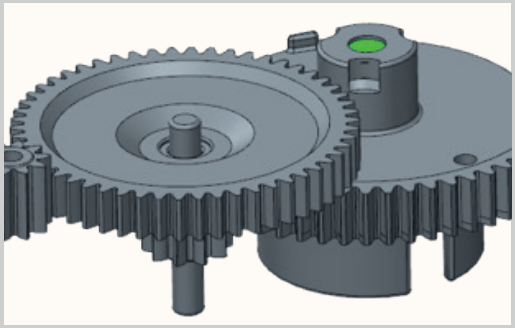


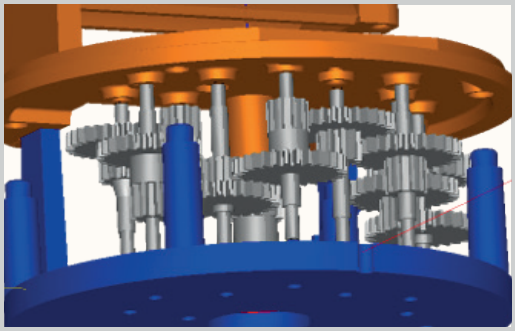


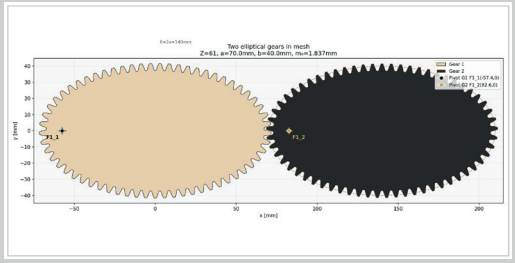


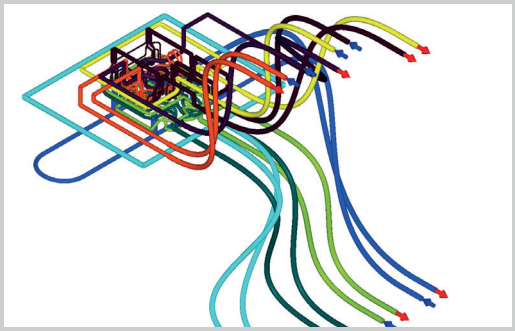
Pos	Question	Yes	No	Remark	A - essential	B - very useful	C - desirable	Comments / Actions
000	Documents							
001	Bearing rating report available	X						
002	Bearing drawings available		X		X			SKF should provide bearing drawings. The drawing should show d, D, B, C, C0 and the full bearing name / designation.
003	Bearing locations drawing available		X		X			WOC should create a drawing showing the position of all bearings (e.g. with respect to a global coordinate system)
100	General							
101	Includes static rating	X						
102	Includes life rating with equivalent load	X						
103	Includes life rating with LDO		X		X			SKF to run calculations with load spectrum / Miner rule. SKF should list the LDOthreshold in their report.
104	Includes stress rating with static load	X						
105	Includes stress rating with equivalent load	X						
106	Are hoking loads for HCS given		X		X			WOC should give hoking loads to SKF SKF should consider hoking loads for rating of one gear shaft. At least stress levels for hoking loads should be shown. If there are no hoking loads, the report should state that hoking loads are zero.
107	Are masses of planet carriers given		X		X			WOC should give masses of planet carriers to SKF SKF should give the power of active bearings using these masses and other forces acting on the planet carrier bearings (if any)
200	Calculation details							
201	Lubricant viscosity, cleanliness and temperature considered and documented	X						
202	Bearing temperature (oil temperature) in line with ISO81400, Table 4	X						
203	Outer and inner race temperature in line with ISO81400, Table 5	X						
204	Shaft and housing fit listed	X						
205	Operating clearance calculated considering temperatures and fit	X						
206	Is ATAS known to SA	X						
207	Are contact stresses lower or similar to ISO81400 table 3	X						
208	Is filtered system assessed for ATAS risk/system	X						

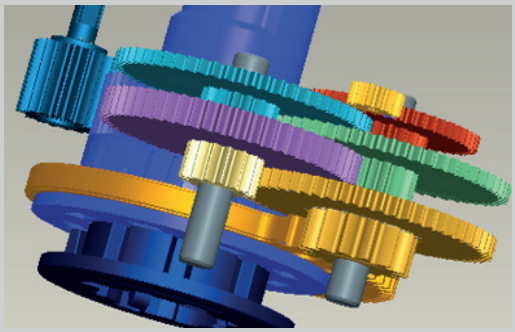


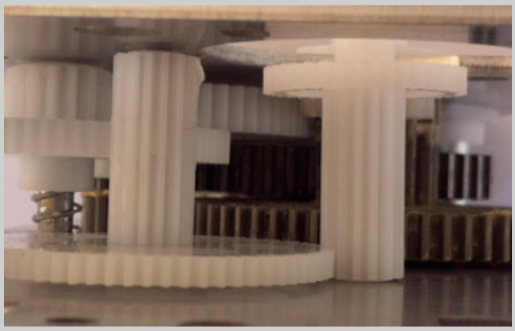












Projects Experience: Plastic Gears

Oval and elliptical gearing, Switzerland
- Geometry calculation, ratio ranges
- Tooth form generation
- Using own PYTHON code

Wheel hub drive, China
- Planetary gear set with plastic planets
- Tooth geometry optimization, strength rating

HVAC actuator, Czech Republic
- Gear sizing and optimization
- Design space minimization, rating

Washing machine drive, New Zealand
- Planetary gear design, geometry optimization
- Fatigue and overload rating

Valve drive, Czech Republic
- Gear sizing and optimization
- Design space minimization, rating

Valve actuator for engine compartment, China
- Gear sizing and optimization for high temperature
- Wear assessment, material selection

Kitchen appliance, grinder, India
- Gear design for two speed gearbox
- Life and strength rating

High ratio water meter, Switzerland
- Gear friction minimization, mold cavity geometry

HVAC actuator, USA
- Training, design review, gear optimization
- Test assessment

Aerospace actuators, China
- Multi stage planetary, bevel planetary, four types
- Small diameter gears for vacuum application

"... Your knowledge is priceless. Meeting you was a great privilege during my KISSsoft training at Gleason. ... As a plastic gear designer, you brought me so much more knowledge than I expected from a software class..."

Heather Fox, ABA-PGT, USA

Projects Experience: Literature, Patents

Study on aerospace ring gears, Korea
- Materials and heat treatment
- Supporting structures design, extensive patent search
- Reports 75 and 160 pages

Study on helicopter gearbox lubrication, Korea
- Principles, equipment, loss of oil
- Lubricant flow, pump design, port design
- Report 150 pages

Study on use of Flexpin in wind turbine gearboxes, Korea
- For planetary gears with hydrodynamic bearings
- For spur and helical gears
- Patents and literature review
- Report 150 pages

Study on CVT, IVT, DCT tractor transmissions, Korea
- Contemporary designs for tractors of all power ratings
- Focus on continuously variable transmissions
- With hydrostatic, hydrodynamic, electrical and other types of variators
- Report 120 pages

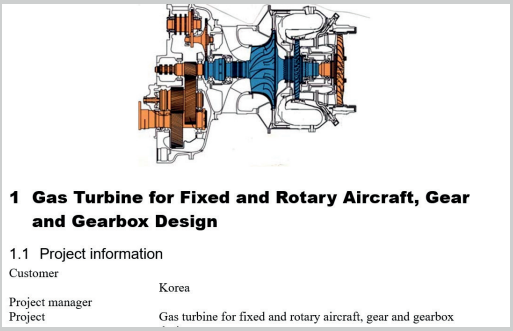
Study on aerospace light weight gear body design, Korea
- Extensive FEM, analytical calculations, including topological optimizations
- Methodology development
- Report 100 pages

Study helicopter gearbox concepts, Korea
- Literature, maintenance manuals, accident reports analysis, patents review
- Extensive use of NASA, US ARMY publications
- Report 150 pages

Study tractor transmission calculations, Korea
- Based on own experience, relevant standards and research at TUM Munich
- Guide on calculation procedures
- Report 100 pages

"... Dear Mr. Dinner, thank you very much for ... assistance on our ongoing jacking gear project... your assistance was invaluable in helping my department get everything done in a very timely manner ... looking forward to working with you ..."

Mr. Mehul Parekh, General Manager, JVS Engineers, India



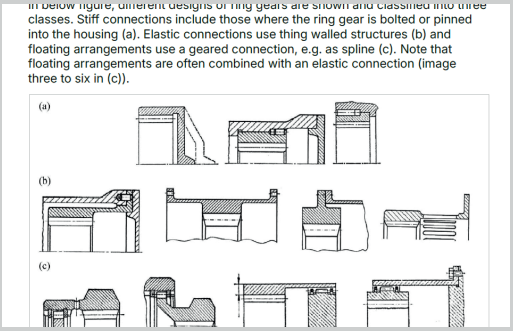
1 Gas Turbine for Fixed and Rotary Aircraft, Gear and Gearbox Design

1.1 Project information

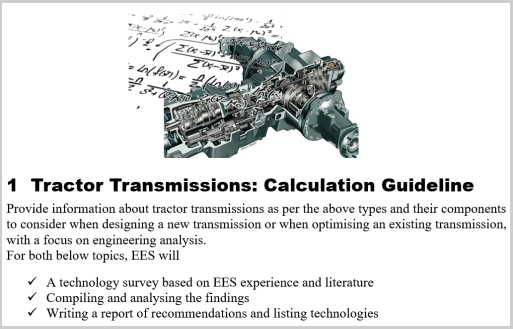
Customer — Korea

Project manager

Project — Gas turbine for fixed and rotary aircraft, gear and gearbox



In below figure, different designs of ring gears are shown and classified into three classes. Stiff connections include those where the ring gear is bolted or pinned into the housing (a). Elastic connections use thing walled structures (b) and floating arrangements use a geared connection, e.g. as spline (c). Note that floating arrangements are often combined with an elastic connection (image three to six in (c)).



1 Tractor Transmissions: Calculation Guideline

Provide information about tractor transmissions as per the above types and their components to consider when designing a new transmission or when optimising an existing transmission, with a focus on engineering analysis.
For both below topics, EES will

- ✓ A technology survey based on EES experience and literature
- ✓ Compiling and analysing the findings
- ✓ Writing a report of recommendations and listing technologies

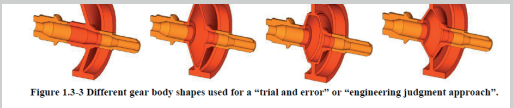
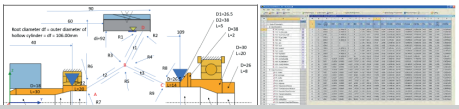
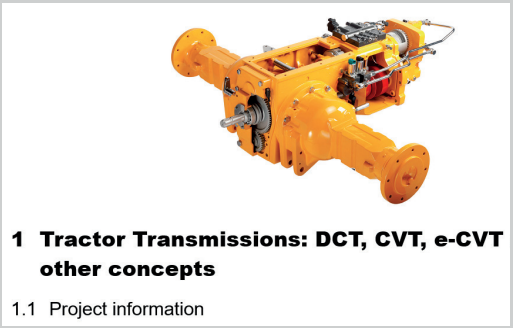


Figure 1.3-3 Different gear body shapes used for a "trial and error" or "engineering judgment approach".

Study 3, Parametric variation with ANSYS
The design of the gear body is represented by three sections, AB, CB, DB with individual thickness. Also, fillet radii are applied at the points A, B, C, D. The position of point A, B, C, D and the section thickness as well as the fillet radii are varied using an automatic function in ANSYS by means of a Design of Experiment DOE approach. Thereby, an optimal design is found resulting in low mass while not exceeding a pre-defined stress level and not exceeding a predefined gear tooth misalignment.





1 Tractor Transmissions: DCT, CVT, e-CVT other concepts

1.1 Project information

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[201] Selçuk, B., Ipek, R., Karamış, M.B., "A study on friction and wear behaviour of carburized, carbonitrided and borided AISI 1020 and 5115 steels", Journal of Materials Processing Technology, vol. 141, 2003, pp. 189-196.
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[204] Miwa, Y., Suzawa, M., Arimi, Y., Kojima, Y., Nishimura, K., "Carbonitriding and Hard Shot Peening for High-Strength Gears", SAE International Congress and Exposition, 1988.
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[206] Townsend, Dennis P., Zaretsky, Erwin V., "Comparisons of Modified VASCO X-2 and AISI 9310 Gear Steels", NASA Technical Paper 1731, 1980.
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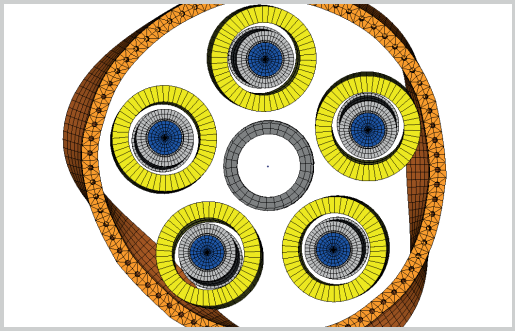
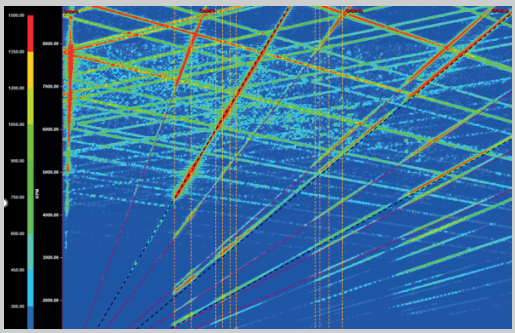
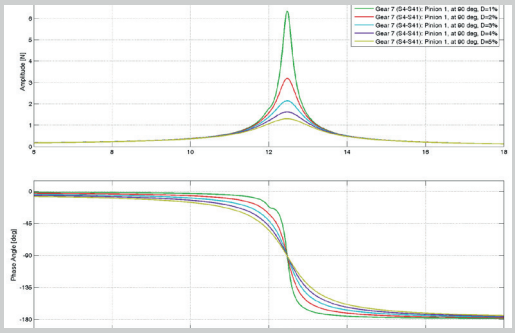
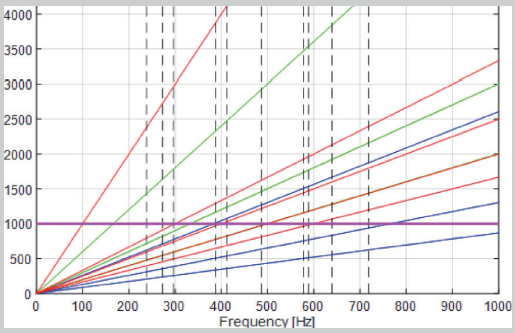
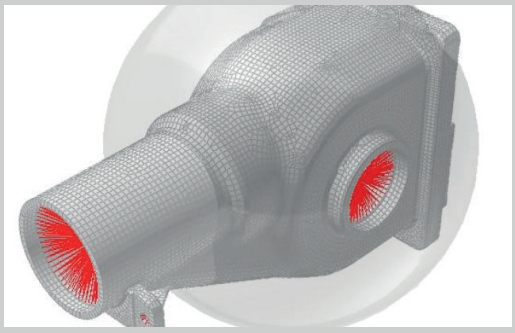
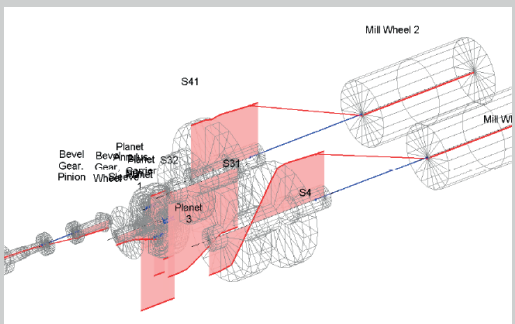












Dynamic Simulation

Modal analysis
- Using MADYN 2000, MESYS, KISSsoft
- For shaft-systems, housings and planetary stages
- Torsional, lateral, coupled

Eigenmode calculations with FEM
- For complex geometries including whole drive trains
- Gear contact modeled as springs with adequate stiffness to represent gear mesh stiffness
- Using ABAQUS
- In collaboration with INGENIS AG, Switzerland

Rotor dynamics
- Using MADYN 2000
- For geared systems including planetary and bevel gears or coaxial shaft systems
- In collaboration with DELTA JS, Switzerland

Forced response
- Using RECURDYN
- Housing response due to e.g., gear excitation
- Sound pressure level calculation
- In collaboration with GEARLAB, Switzerland

Gear mesh excitation
- KISSsoft loaded tooth contact analysis
- Transmission error and its spectral content
- Force or displacement amplitudes as excitation

Excitation frequencies
- Gear mesh frequencies including side bands from shaft speed
- Bearing fault, ball passing and other frequencies
- Critical speed map and Campbell diagram

"... In my (quite long) professional career, I have met very few people with your level of expertise with whom working together has been as pleasant and enlightening ..."

Martin Lehnhoff, Lehnhoff Consulting, Germany

Gear Design: KISSsoft

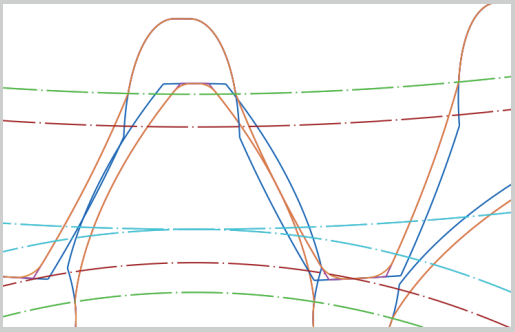
Cylindrical gears
- Macro and micro geometry, tolerances
- Backlash, contact ratio, clearances
- Manufacturing steps, active and form diameters
- 2D and 3D geometry
- Strength rating with load spectrum

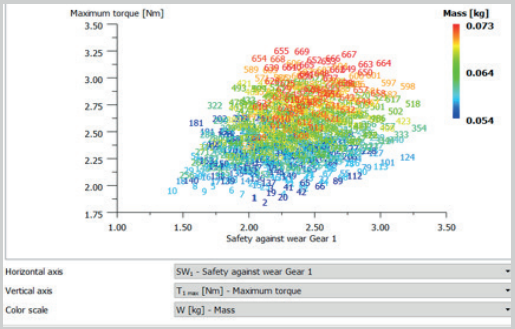
Plastic gears
- Life rating, static strength, temperature influence
- Form optimization, cavity calculation
- Consideration of shrinkage, wire and spark gap
- Non-trochoidal root shapes, non-involute gears

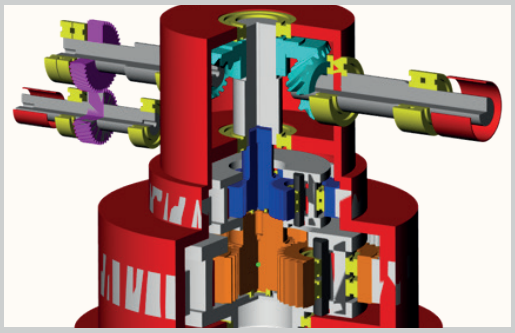
System model
- Interconnected calculations to consider shaft-hub connections, coaxial shaft assemblies, gear stages
- Kinematics, power flow, load spectra
- System efficiency, power losses

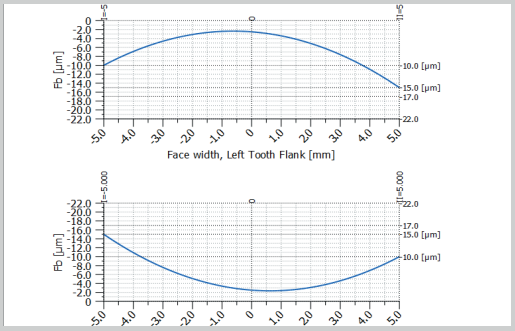
Other gear types
- Bevel gear design and rating
- Worm gear design and rating
- Face gear design and rating

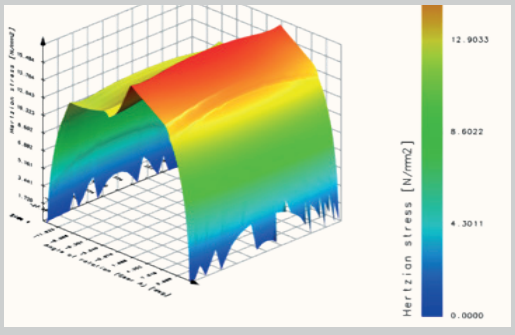
Contact analysis
- Line load and stress distribution
- Transmission error with peak-to-peak value
- Spectral content of transmission error
- Wear estimate based on local contact pressure
- Face load distribution factor calculation
- Design of modifications

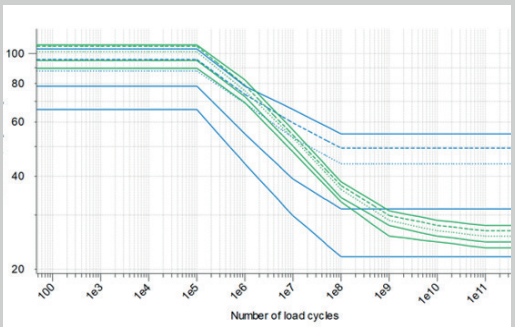






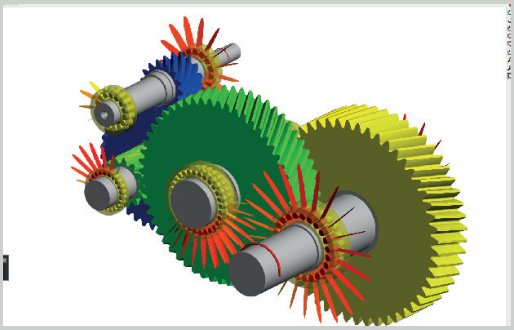


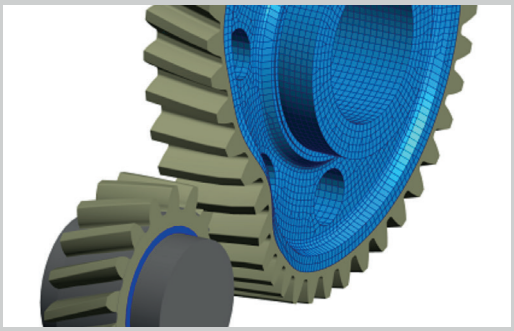


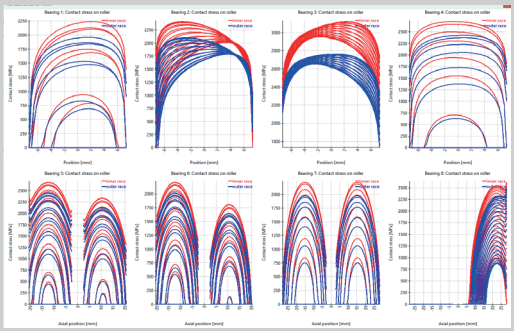


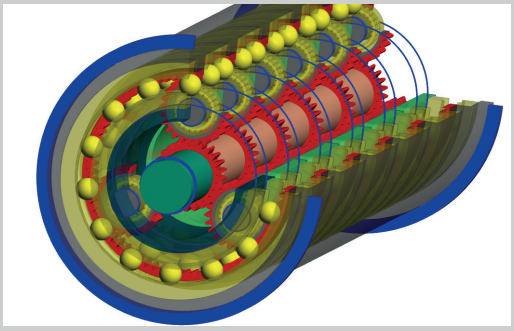
"... You are a person of integrity in both the personal and professional arena. There was never a time we had a discussion and I didn't learn something new, especially when you asked profound questions targeting the core of every issue ..."

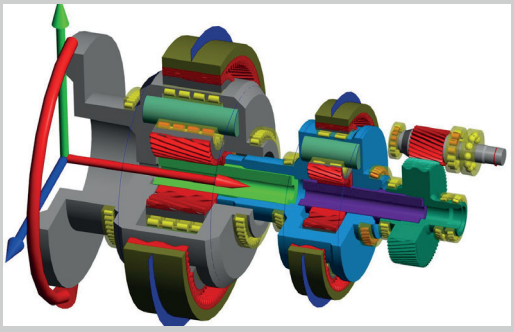
Ioannis Kaliakastos, Reishauer AG, Switzerland

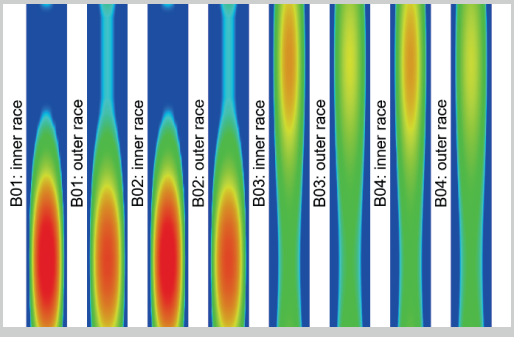












Elastic Systems, Bearing Analysis: MESYS

Planetary gears

- Load distribution among planets and along face width considering bearing clearance, positioning errors and carrier elasticity
- Misalignment of carrier group due to external bending forces, mass and gear contact forces
- Influence of carrier bearings clearance on carrier and sun gear position
- Coupled planetary stages for transmissions and robotic gear sets

Full FEM model of supporting structures

- Flexible housing influences bearing load distribution and gear line load distribution for face load factor calculation
- Elastic support structure to consider misalignment of input and output shaft, e.g., to simulate test stand misalignment or wind turbine main shaft bending
- FEM model of gear body to consider its effect on line load distribution
- Housing and bearing ring ovalization, planet bearing load distribution considering planet gear deformation
- Consideration of housing stiffness on natural frequencies and natural modes, housing modes
- Thin walled structures for aerospace application

Bearing analysis

- Bearing kinematics, operating clearance, load distribution surface and sub-surface stresses
- Basic, modified, reference and modified reference rating life for statically overdetermined systems
- Life rating for hybrid and steel bearings

Parameter variation

- What-if studies, simple parameter sweep, stochastic parameter sweep
- COM interface for parameter control from other software
- Variation of single or multiple parameters simultaneously

"... Dear Hanspeter, our many conversations over the years have always been truly inspiring, marked by clarity of thought, technical depth, and a genuine interest in people and collaboration. ... encouraged us to pursue our path at ZHAW and to further develop our research in gears ..."

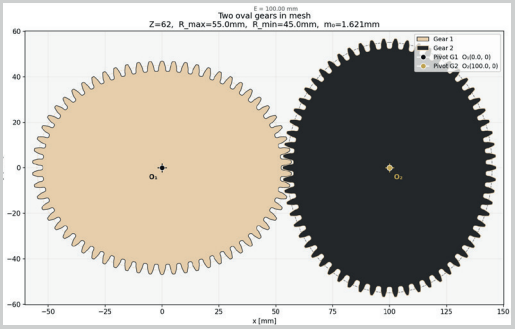
Hans-Jörg Dennig, ZHAW, Switzerland

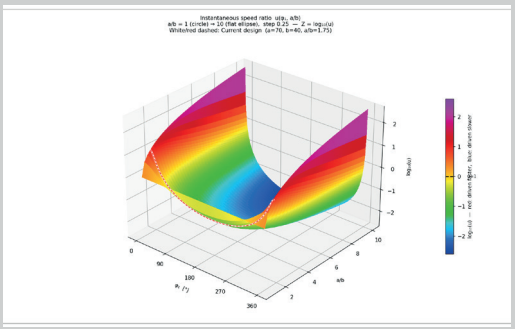
Simulation, Technologies, Coding

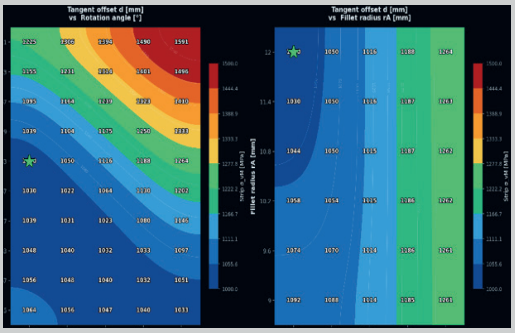
FEM analysis types, through partners
- Static or modal analysis
- Non-linear (deformation, contact, material)
- Tooth contact analysis, bearing load distribution
- With ABAQUS, FEMAP, ANSYS Workbench

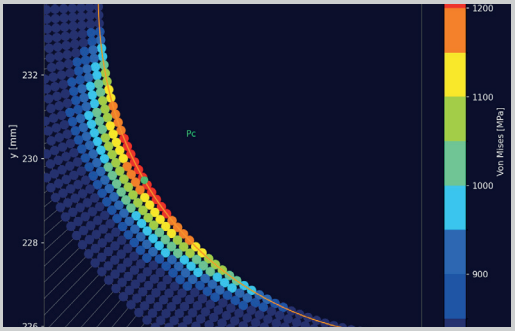
Technologies
- Fatigue analysis of welded, machined, cast parts
- Synthetic S-N curves, load spectra and time series
- Planetary gearbox load distribution analysis using parametrized spring - gap FEM models
- Assembly simulation to consider e.g. bolt pretension
- Topological optimization for structural parts
- Consideration of elastic housing and planetary carriers for bearing load distribution in MESYS
- Cylindrical gear root optimization on virtual spur gear or transverse section using own code

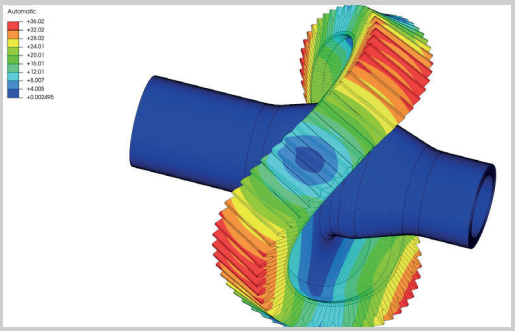
Other simulation
- Non-circular gears generation
- Oval and elliptical gear ratio mapping
- Optimized mesh for cylindrical gears
- Direct calculation of nodal coordinates, direct definition of element connectivity
- Mesh generation for CALCULIX
- Post processing with PYTHON code
- Use of PrePoMax for analysis, pre- and post-processing

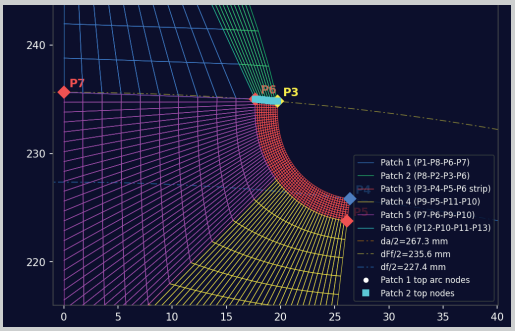




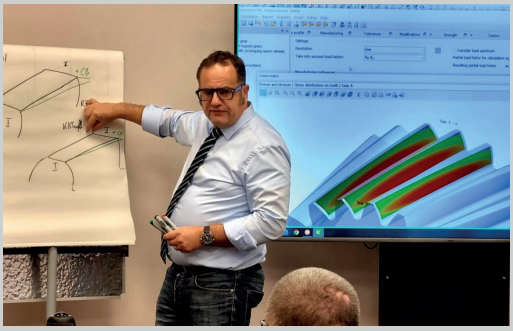


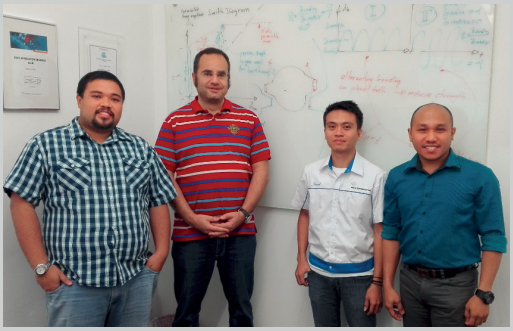






"... Dear Hanspeter Dinner, from initial days of KISSsoft introduction, your contribution to fine-tune the software and develop the global customer base are much appreciated. The training sessions are invaluable. Wishing ... for your successful growth and continual support to the gear community..."
Mahendran Muthu, Nexgen Gears Pvt., Ltd., India





Training, Mentoring, Standardization Work

Hundreds of engineers have been trained by EES on
- Wind gearboxes / slewing bearings technology
- Plastic gears, planetary gearing
- KISSsoft software
- Gear geometry and strength, theory and standards
- Shaft and bearing rating, bearing theory
- Loaded tooth contact analysis, modifications design
- Gear rating, rating factors

Strategy
- Business development
- Promotion and sales
- Dispute management
- Key account management
- Partner scouting, selection, onboarding and training
- Employee mentoring and assessment

Standardization work
- Member of ISO/TC 60/SC 2/WG 6
- Lead of subgroups on reliability factor, face load distribution and application factor
- Lead of Swiss Standardization Group Gears, SNV NK25
- Comparison and assessment of gear rating standards

"... You have a leadership based on recognition and empowerment of employees ..."

Valeria Busacca, Estudio Pina, Argentina

 Images permission INGENIS AG, MESYS AG, KISSsoft AG.