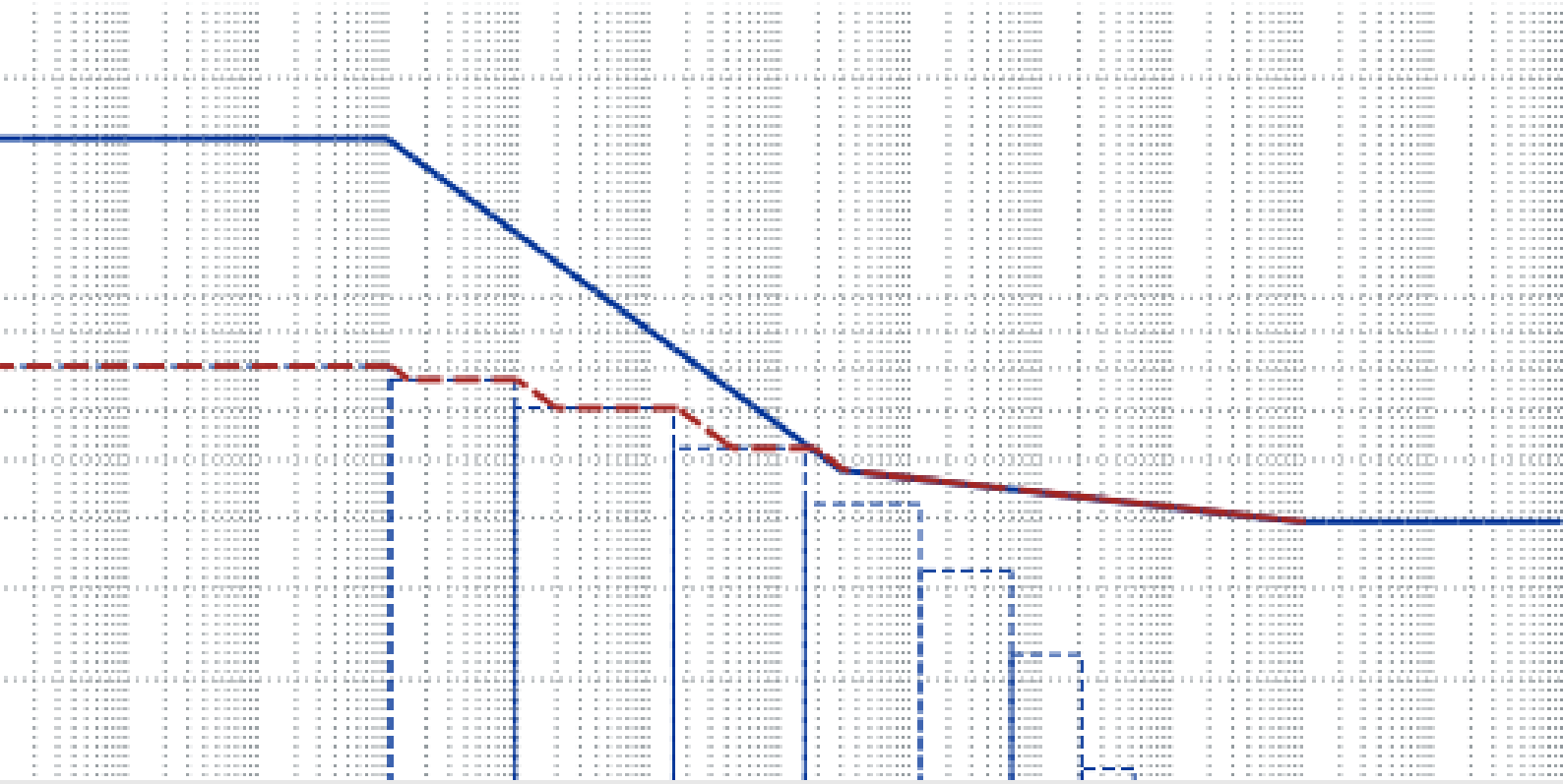
Drivetrain Design Solutions KISSsoft

KISSsoft Live Stream Training

Cylindrical Gear Design, Analysis and Optimization

June 21-23, 2022 (Session 1-3)
June 28-30, 2022 (Session 4-6)



KISSsoft AG
A Gleason Company
Rosengartenstr. 4, 8608 Bubikon
Switzerland

T. +41 55 254 20 50
F. +41 55 254 20 51
info@KISSsoft.com
www.KISSsoft.com

Sharing Knowledge

Session 1: June 21, 2022

2:00 – 2:45 pm	Welcome
2:45 – 4:00 pm	Geometry of cylindrical gears, Reference profile, Backlash, etc.
4:00 – 4:20 pm	Break
4:20 – 6:00 pm	KISSsoft interface basic tabs and database
Exercises	**Playing with the interface to duplicate an existing gear pair** **Introduce hobbing cutters with protuberance and semi topping from a drawing**

Session 2: June 22, 2022

2:00 – 2:45 pm	Exercise follow up
2:45 – 4:00 pm	Theory of cylindrical gears “profile and tooth trace modifications, K diagram, etc.
4:00 – 4:20 pm	Break
4:20 – 6:00 pm	KISSsoft interface special tabs “operating backlash, tooth form, etc.
Exercises	**Determining the required backlash**

Session 3: June 23, 2022

2:00 – 4:00 pm	Theory of contact analysis, KISSsoft user interface, interpretation of results
4:00 – 4:20 pm	Break
4:20 – 5:00 pm	Contact analysis report, settings, etc.
5:00 – 6:00 pm	Contact analysis for planetary gears
Exercises	**Profile modification of a gear pair – Tip relief and transmission error**

Depending on your KISSsoft skills and knowledge, please allow between **15 minutes and 1 hour** of your time after the session for independent completion of the exercises.

Session 4: June 28, 2022

2:00 – 4:00 pm	Calculation of flank and root safeties of gears
4:00 – 4:20 pm	Break
4:20 – 5:00 pm	Alternative root stress calculation, Static safeties, K factors
5:00 – 6:00 pm	Face load factor according to ISO 6336-1 (Method C, Annex E)
Exercises	**Strength rating of a gear pair**

Session 5: June 29, 2022

2:00 – 2:45 pm	Exercise follow up
2:45 – 4:00 pm	Load spectrum analysis, Load spectrum from time series data, Reliability and damage calculation
4:00 – 4:20 pm	Break
4:20 – 6:00 pm	Calculation of scuffing, micropitting and tooth flank fracture
Exercises	**Load spectrum analysis of a gear pair**

Session 6: June 30, 2022

2:00 – 2:15 pm	Exercise follow up
2:15 – 4:00 pm	Rough and fine sizing
4:00 – 4:20 pm	Break
4:20 – 6:00 pm	Sizing of the micro modifications
Exercises	**Optimization of a gear pair**

Depending on your KISSsoft skills and knowledge, please allow between **15 minutes and 1 hour** of your time after the session for independent completion of the exercises.

Session 1 - 2: Geometry of Cylindrical Gears with Involute Profile

- Gearing law, Involute tooth form
- Reference profile and tool geometry
- Tooth form for spur and helical gears, external and internal gears
- Profile shift, Grinding stock allowance, Manufacturing profile shift
- Sizing profile shift coefficient and deep tooth form
- Path of contact, Specific sliding
- Definition of various circles
- Backlash (Theoretical and Operating), Tip clearance
- Operating backlash calculation
- Tolerances and allowances, Quality and deviation
- Various methods for inspection
- Tooth flank modifications (Profile and tooth trace)
- Profile and tooth trace diagram (K chart)
- Measurement grid report
- Most frequent errors found in the geometric design of gear pairs
- Exercises

Session 3: Loaded Tooth Contact Analysis

- Tooth stiffness according to Weber/Banaschek
- Assumptions in the analysis of helical gear teeth
- Actual path of contact and identification of entry and exit impact
- Effective transverse contact ratio and overlap ratio
- Actual normal force and stress distribution
- Transmission error and its relation with vibration and noise
- Effect of the deviation and inclination error of axis
- Combining the shaft calculation
- Contact analysis of planetary gears (options, limits)
- Exercises

Session 4: Strength Rating and Failure Analysis

- Calculation of safety factors, Identifying required safety factors
- Definition of material data and Woehler Line (S-N curve)
- Calculation of the flank safety according to ISO 6336:2019
- Calculation of the root safety according to ISO 6336:2019
- Root stress calculation by FEM (2D and 3D)
- Static strength calculation
- K factors
- Face load factor according to ISO 6336-1 (Method C, Annex E)
- Exercises

Session 5: Strength Rating and Failure Analysis

- Calculation of scuffing (flash temperature and integral temperature)
- Micropitting (On request)
- Tooth flank fracture (On request)
- Load spectrum analysis, Load spectrum from time series data (Rainflow counting)
- Reliability, lifetime, and damage calculation
- Effect of profile and flank modifications on strength
- Interpretation of failure modes and strategies to prevent the failure
- Exercises

Session 6: Strategies for Gear Design Optimization

- Rough sizing to define the raw dimension of gears
- Fine sizing to define macro geometry of gears
- Modification sizing to define microgeometry of gears
- Finding an optimal solution well balanced for various criteria
- Incorporating contact analysis results in sizing functions
- Strategies for optimizing tooth flank form for strength and noise
- Sizing modifications considering load spectrum
- Sizing modifications considering manufacturing errors
- Exercises

The training topics can be adapted to the knowledge level of the participants and upon special request from the participants. If you have any questions on detailed contents or any interest on special topics, please send us an email to training@KISSsoft.com.