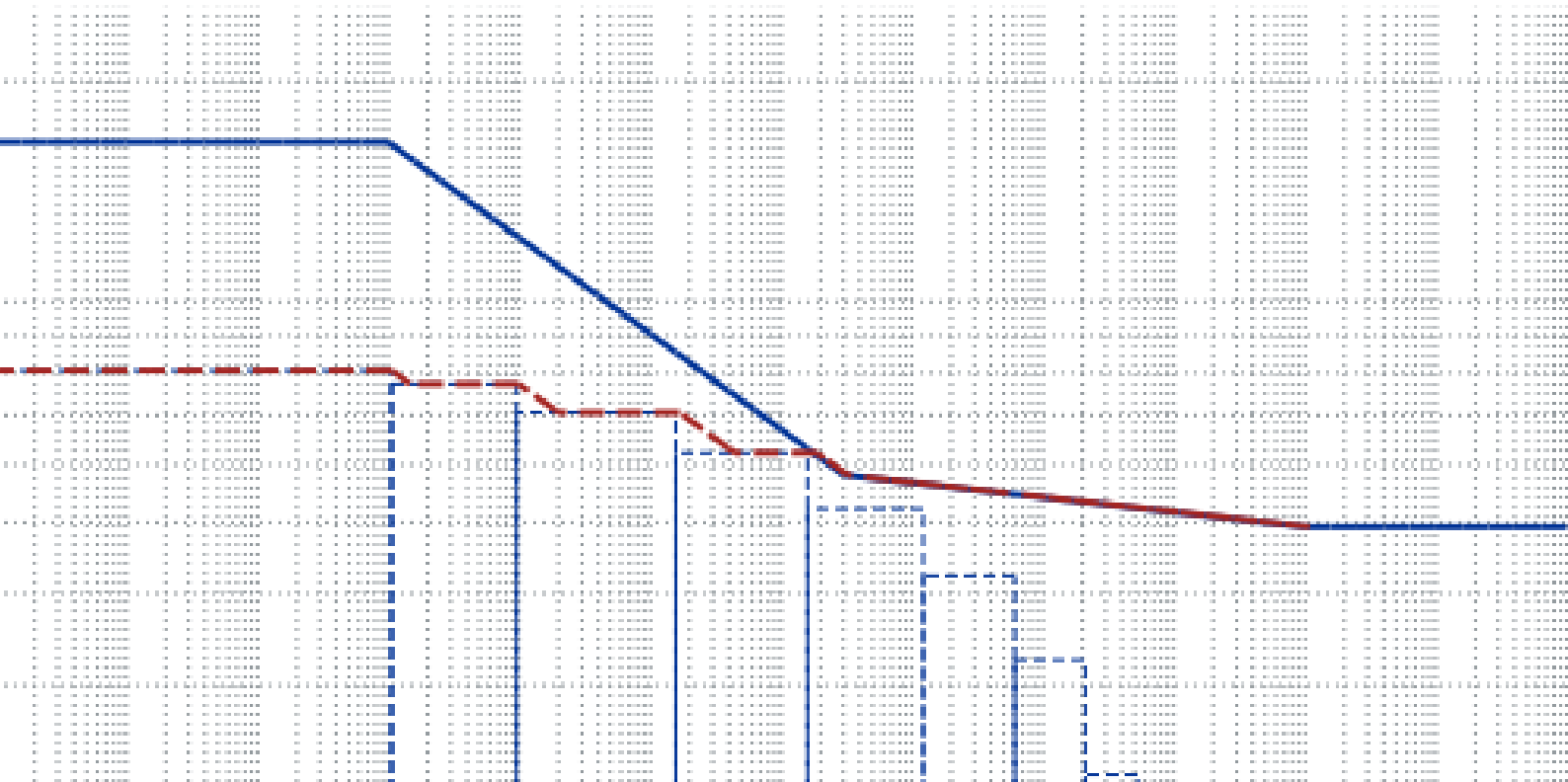


KISSsoft Live Stream Training

Cylindrical Gear Design, Analysis and Optimization

June 15-17, 2021 (week 1)
June 22-24, 2021 (week 2)



Week 1 – Day 1: June 15, 2021

2:00 – 2:45 pm	Welcome
2:45 – 4:00 pm	KISSsoft interface basic tabs and database
4:00 – 4:20 pm	Break
4:20 – 6:00 pm	Geometry of cylindrical gears, Reference profile, Backlash, etc.

Exercises **Playing with the interface to duplicate an existing gear pair**
Introduce hobbing cutters with protuberance a semi topping from a drawing

Week 1 – Day 2: June 16, 2021

2:00 – 2:45 pm	Exercise follow up
2:45 – 4:00 pm	Profile and tooth trace modifications, K diagram, Operating backlash, Tooth form etc.
4:00 – 4:20 pm	Break
4:20 – 6:00 pm	Rough sizing, Fine sizing, etc.

Exercises **Determining the required backlash**

Week 1 – Day 3: June 17, 2021

2:00 – 4:00 pm	Calculation of flank and root safeties of gears
4:00 – 4:20 pm	Break
4:20 – 6:00 pm	Alternative root stress calculation, Static safeties, K factors

Exercises **Strength rating of a gear pair**

Week 2 – Day 1: June 22, 2021

2:00 – 2:45 pm	Exercise follow up
2:45 – 4:00 pm	Load spectrum analysis, Rainflow counting, Reliability analysis and damage calculation
4:00 – 4:20 pm	Break
4:20 – 6:00 pm	Calculation of scuffing, micropitting and tooth flank fracture safeties

Exercises **Load spectrum analysis of a gear pair**

Week 2 – Day 2: June 23, 2021

2:00 – 2:15 pm	Face load factor according to ISO 6336-1 (Method C, Annex E)
2:15 – 4:00 pm	Theory of contact analysis
4:00 – 4:20 pm	Break
4:20 – 6:00 pm	Contact analysis of a cylindrical gear pair

Exercises **Contact analysis of a cylindrical gear pair**

Week 2 – Day 3: June 24, 2021

2:00 – 2:15 pm	Exercise follow up
2:15 – 4:00 pm	Interpretation of contact analysis results, Modification sizing
4:00 – 4:20 pm	Break
4:20 – 6:00 pm	Contact analysis of a planetary gear
Exercises	Optimization of a gear pair

Week1 – Day 1 and 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
- Rough sizing to define the raw dimension of gears
- Fine sizing to define macro geometry of gears
- Exercises

Week 1 – Day 3 and Week 2 – Day 1: 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
- Calculation of scuffing (flash temperature and integral temperature)
- Micropitting (On request)
- Tooth flank fracture (On request)
- Load spectrum analysis, 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
- Sizing modifications considering load spectrum
- Sizing modifications considering manufacturing errors
- Exercises



Week 2 – Day 2 and 3: Loaded Tooth Contact Analysis

- Basic principle of loaded tooth contact analysis (LTCA)
- 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
- Calculation of face load factor according to ISO 6336-1 Annex E
- Micropitting by contact analysis
- Incorporating contact analysis results in sizing functions
- Modification sizing to define microgeometry of gears
- 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 trainings@KISSsoft.com.

