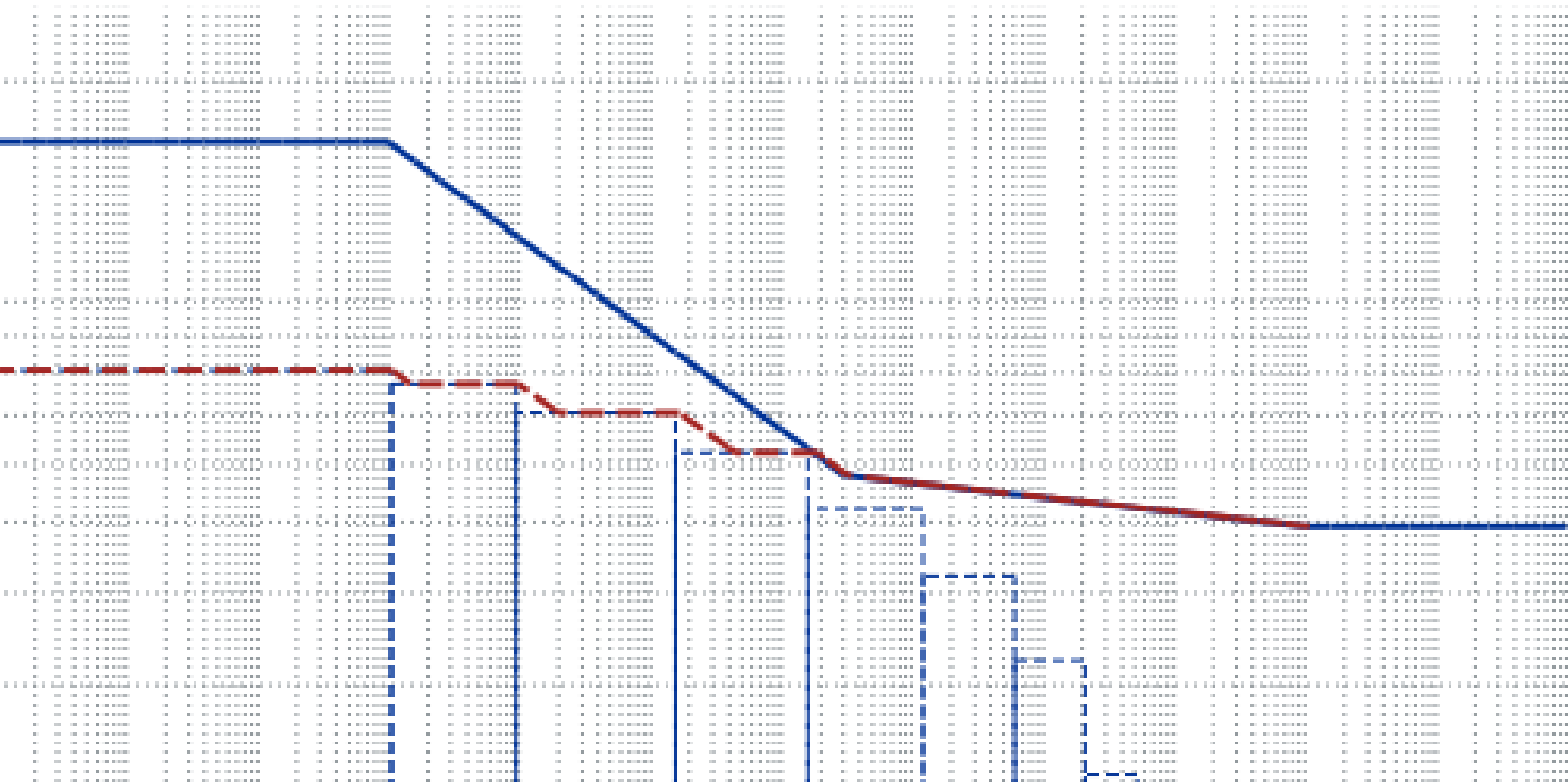


KISSsoft Live Stream Training

Cylindrical Gear Design, Analysis and Optimization

October 26-28, 2021 (week 1)
November 2-4, 2021 (week 2)



Week 1 – Day 1: October 26, 2021

08:30 – 08:45	Welcome
08:45 – 10:10	KISSsoft interface basic tabs and database
10:10 – 10:30	Break
10:30 – 12:00	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
16:00 – 17:00	Questions

Week 1 – Day 2: October 27, 2021

08:30 – 08:45	Exercise follow up
08:45 – 10:10	Profile and tooth trace modifications, K diagram, Operating backlash, Tooth form etc.
10:10 – 10:30	Break
10:30 – 12:00	Rough sizing, Fine sizing, etc.
Exercises	Determining the required backlash
16:00 – 17:00	Questions

Week 1 – Day 3: October 28, 2021

08:30 – 10:00	Calculation of flank and root safeties of gears
10:00 – 10:20	Break
10:20 – 12:00	Alternative root stress calculation, Static safeties, K factors
Exercises	Strength rating of a gear pair
16:00 – 17:00	Questions

Week 2 – Day 1: November 2, 2021

08:30 – 08:45	Exercise follow up
08:45 – 10:00	Load spectrum analysis, Rainflow counting, Reliability analysis and damage calculation
10:00 – 10:20	Break
10:20 – 12:00	Calculation of scuffing, micropitting and tooth flank fracture safeties
Exercises	Load spectrum analysis of a gear pair
16:00 – 17:00	Questions

Week 2 – Day 2: November 3, 2021

08:30 – 08:45 Face load factor according to ISO 6336-1 (Method C, Annex E)

08:45 – 10:10 Theory of contact analysis

10:10 – 10:30 Break

10:30 – 12:00 Contact analysis of a cylindrical gear pair

Exercises **Tooth trace modification on a gear pair, Profile modification on a gear pair**

16:00 – 17:00 Questions

Week 2 – Day 3: November 4, 2021

08:30 – 08:45 Exercise follow up

08:45 – 10:10 Interpretation of contact analysis results, Modification sizing

10:10 – 10:30 Break

10:30 – 12:00 Contact analysis of a planetary gear

Exercises **Optimization of a gear pair**

16:00 – 17:00 Questions

Week 1 – 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 Part 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.

