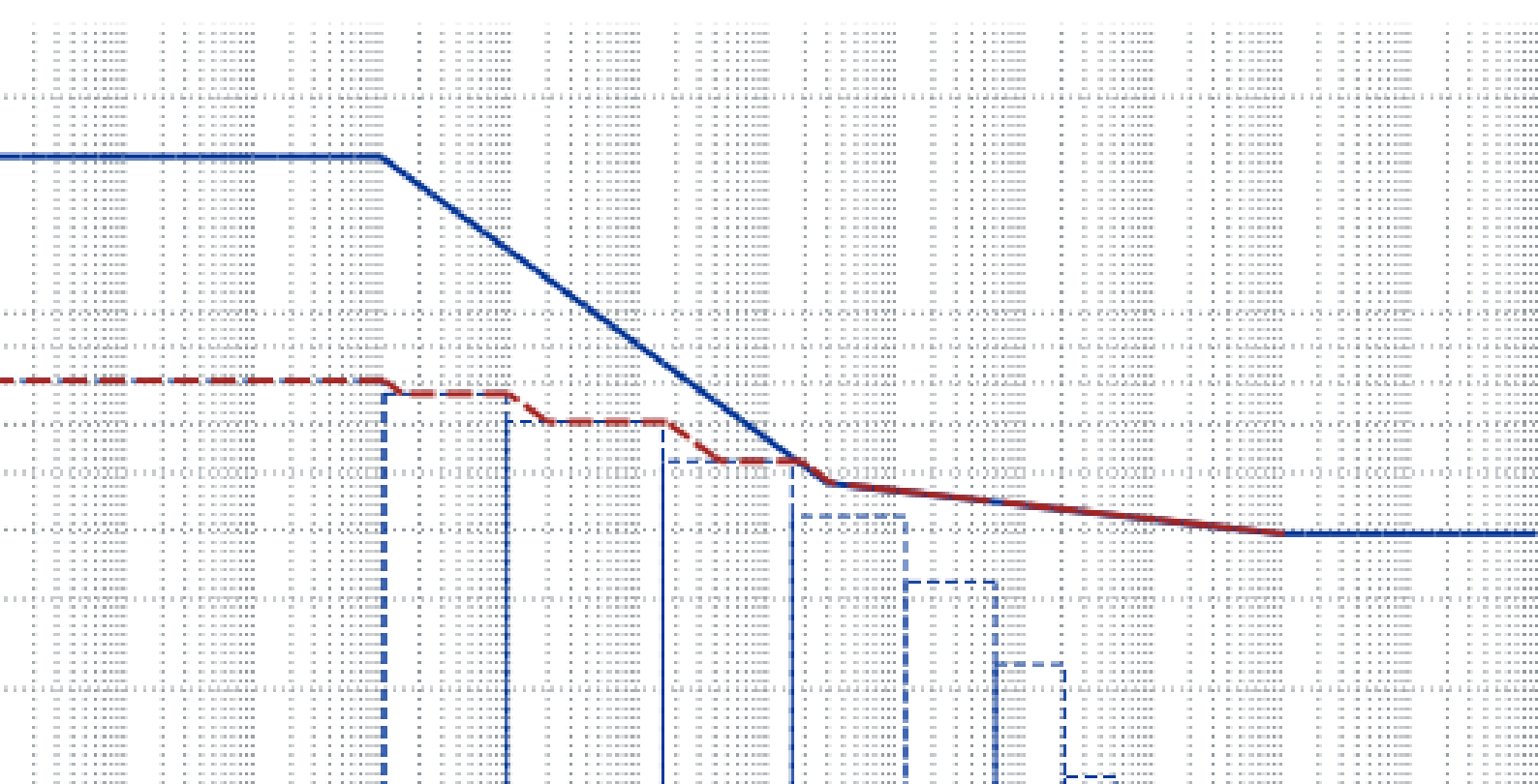


KISSsoft Live Stream Training

Advanced: Cylindrical Gear Design, Analysis and Optimization

November 14-16, 2023 (session 1-3)
November 20-22, 2023 (session 4-6)



The below schedule is shown in the time zone CET 2:00 pm – 6:00 pm (Brussels)

Session 1: November 14, 2023

02:00 – 02:10	Welcome
02:10 – 04:00	Geometry of cylindrical gears (Gearing law, Reference profile, etc.)
04:00 – 04:20	Break
04:20 – 06:00	Geometry of cylindrical gears (Profile shift, Path of contact, etc.)

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

Session 2: November 15, 2023

02:00 – 02:30	Exercise follow up
02:30 – 04:00	Geometry of cylindrical gears (Backlash, Tolerance, etc.)
04:00 – 04:20	Break
04:20 – 06:00	Geometry of cylindrical gears (Tooth flank modifications, K chart, etc.)

Exercises **Determining the required backlash**

Session 3: November 16, 2023

02:00 – 04:00	Strength of cylindrical gears (Safety factors, Flank and root safeties, etc.)
04:00 – 04:20	Break
04:20 – 06:00	Strength rating and failure analysis (Static strength, K factors, etc.)

Exercises **Strength rating of a gear pair**

Session 4: November 20, 2023

02:00 – 02:30	Exercise follow up
02:30 – 04:00	Strength of cylindrical gears (Load spectrum analysis, etc.)
04:00 – 04:20	Break
04:20 – 06:00	Strength of cylindrical gears (Scuffing, Micropitting, etc.)

Exercises **Load spectrum analysis 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**.

The below schedule is shown in the time zone CET 2:00 pm – 6:00 pm (Brussels)

Session 5: November 21, 2023

02:00 – 02:30	Exercise follow up
02:30 – 04:00	Strength of cylindrical gears (Tooth flank fracture, etc.)
04:00 – 04:20	Break
04:20 – 05:00	Strength of cylindrical gears (Effect of flank modification, etc.)
05:00 – 06:00	Basics of loaded tooth contact analysis

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

Session 6: November 22, 2023

02:00 – 02:15	Exercise follow up
02:15 – 04:00	Rough and fine sizing
04:00 – 04:20	Break
04:20 – 06:00	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: Geometry of Cylindrical Gears with Involute Profile, Part I

- 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

Session 2: Geometry of Cylindrical Gears with Involute Profile, Part II

- 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: Strength of Cylindrical Gears, Part I

- Calculation of 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
- Alternative methods for root stress calculation (Graphical method and FEM)
- Static strength calculation
- K factors
- Identifying required safety factors
- Exercises



Session 4: Strength of Cylindrical Gears, Part II

- Load spectrum analysis
- Load spectrum from time series data (Rainflow counting)
- Reliability, lifetime, and damage calculation
- Calculation of scuffing (flash temperature and integral temperature)
- Micropitting
- Exercises

Session 5: Strength of Cylindrical Gears, Part III, Basics of Tooth Contact Analysis

- Tooth flank fracture
- Subsurface fatigue
- Effect of profile and flank modifications on strength
- Face load factor calculation according to ISO 6336-1 Annex E
- Loaded tooth contact analysis according to Weber/Banaschek
- Actual path of contact and identification of entry and exit impact
- Actual normal force and stress distribution
- Transmission error and its relationship with vibration and noise
- Effect of the deviation and inclination error of the axis
- Exercises

Session 6: Strategies for Gear Design Optimization

- Rough sizing to define the raw dimension of gears
- Fine sizing to define the macro geometry of gears
- Modification sizing to define the micro geometry 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, please send an email to training@KISSsoft.com.

