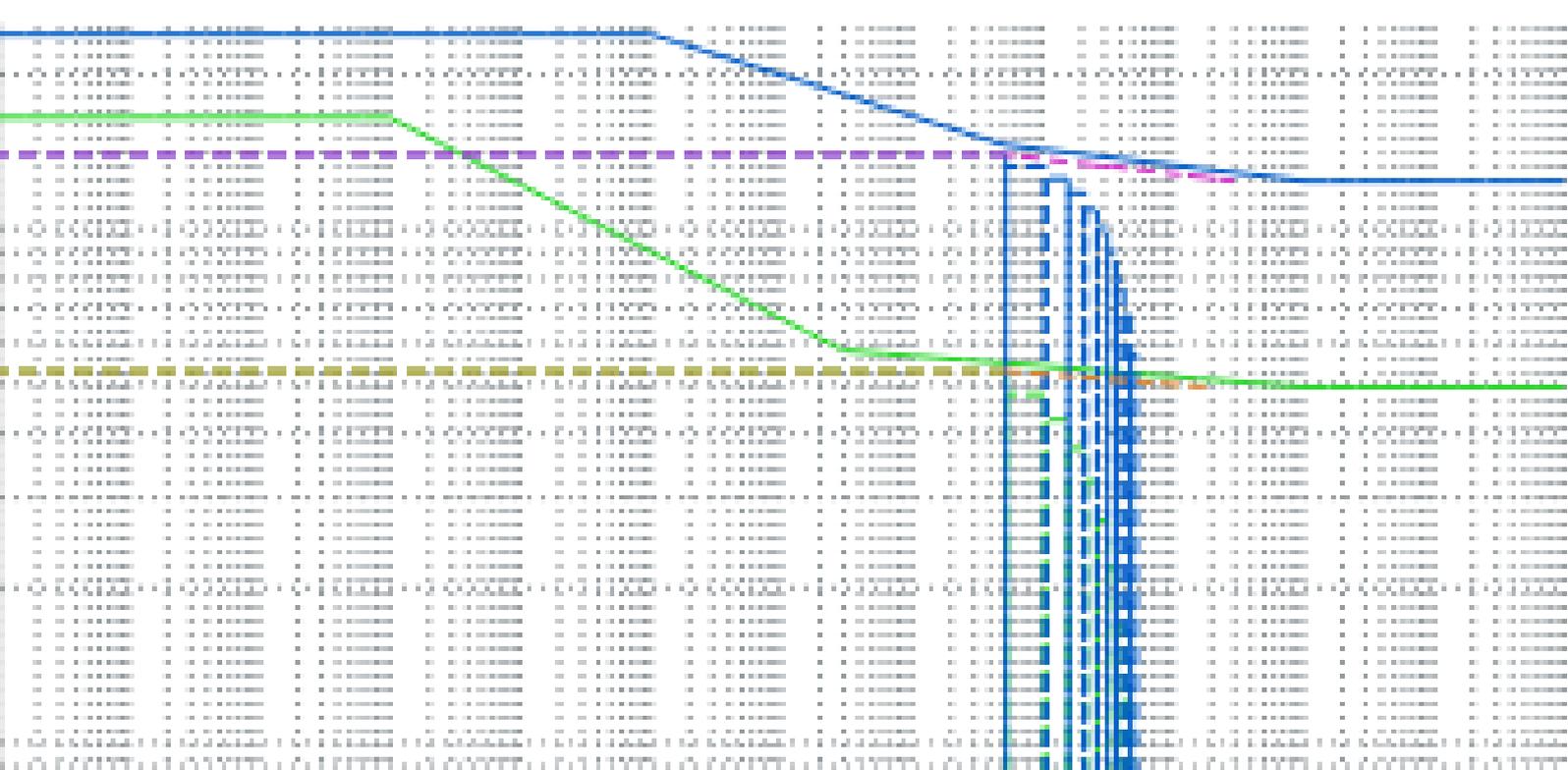


# KISSsoft Live Stream Training

## Cylindrical Gear Design, Analysis and Optimization

October 20-22, 2020 (part 1)

October 27-29, 2020 (part 2)



## Part 1 – Day 1: October 20, 2020

08:30 – 08:45	Welcome
08:45 – 10:10	Theory of cylindrical gears “geometry, reference profile, backlash, etc.”
10:10 – 10:30	Break
10:30 – 12:00	KISSsoft interface basic tabs and database
<b>Exercises</b>	<b>Playing with the interface to duplicate an existing gear pair</b> <b>Introduce hobbing cutters with protuberance a semi topping from a drawing</b>
16:00 – 17:00	Questions

## Part 1 – Day 2: October 21, 2020

08:30 – 08:45	Exercise follow up
08:45 – 10:10	Theory of cylindrical gears “profile and tooth trace modifications, K diagram, etc.”
10:10 – 10:30	Break
10:30 – 12:00	KISSsoft interface special tabs “operating backlash, tooth form, etc.”
<b>Exercises</b>	<b>Determining the required backlash</b>
16:00 – 17:00	Questions

## Part 1 – Day 3: October 22, 2020

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 in KISSsoft, interpretation of results
<b>Exercises</b>	<b>Tooth trace modification on a gear pair</b> <b>Profile modification on a gear pair</b>
16:00 – 17:00	Questions

## Part 2 – Day 1: October 27, 2020

08:30 – 10:00	Calculation of flank and root safeties of gears
10:00 – 10:20	Break
10:20 – 12:00	Calculation of scuffing, micropitting and tooth flank fracture safeties of gears
<b>Exercises</b>	<b>Strength rating of a gear pair</b>
16:00 – 17:00	Questions

## Part 2 – Day 2: October 28, 2020

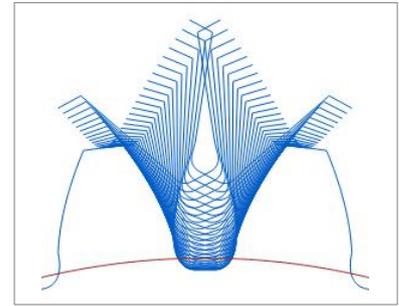
08:30 – 08:45	Exercise follow up
08:45 – 10:00	Load spectrum analysis, Rainflow counting
10:00 – 10:20	Break
10:20 – 12:00	Reliability analysis and damage calculation
<b>Exercises</b>	<b>Reliability analysis of a gear pair</b>
16:00 – 17:00	Questions

## Part 2 – Day 3: October 29, 2020

08:30 – 08:45	Exercise follow up
08:45 – 10:10	Rough and fine sizing
10:10 – 10:30	Break
10:30 – 12:00	Sizing of the micro modifications
<b>Exercises</b>	<b>Optimization of a gear pair</b>
16:00 – 17:00	Questions

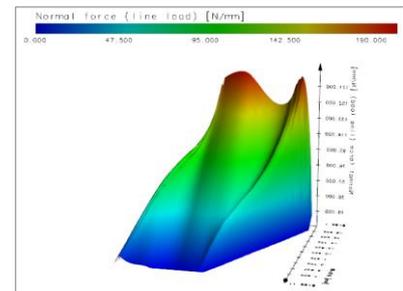
## Part 1 – Day 1 and 2: Geometry of Cylindrical Gears with Involute Profile

- 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
- Exercises



## Part 1 – Day 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
- Exercises



## Part 2 – Day 1 and 2: Strength Rating and Failure Mode Analysis

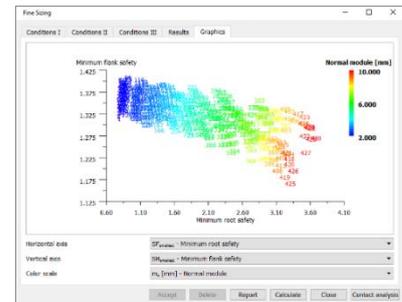
- Calculation of safety factors, Identifying required safety factors
- Definition of material data and Woehler Line (S-N curve)
- Calculation of the flank safety according to ISO 6336:2019
- Calculation of the root safety according to ISO 6336:2019
- Root stress calculation by FEM (2D and 3D)
- Static 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
- Exercises

## Part 2 – Day 3: 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 [trainings@kisssoft.com](mailto:trainings@kisssoft.com).