KISSsoft Advanced Training Course

Contact pattern Analysis for Cylindrical, Bevel and planetary gears (2 Days)

KISSsoft AG
Rosengartenstrasse 4
8608 Bubikon
Switzerland

Tel: +41 55 254 20 50
Fax: +41 55 254 20 51
info@KISSsoft.AG
www.KISSsoft.AG
Special training course about contact analysis

This special training course about contact analysis for calculating cylindrical-, bevel gear pairs and planetary systems will cover the theoretical foundations of contact analysis, which are required for sizing and optimizing gear units with regard to noise, transmission error, transverse contact ratio and tooth trace modifications.

This training course is designed for engineers who are already familiar with cylindrical gears and planetary gear units. The course assumes that participants already know how to use the KISSsoft user interface, either because they use the software on a regular basis or because they have already attended an introductory training course. Before attending the course, interested participants can ask for a 30 day test version from KISSsoft AG in order to become familiar with the basic functionality of the software. We also recommend they attend the advanced training course about gear calculation, because a sound knowledge of geometry and strength calculation is essential for properly understanding the contents of this course.

The first part of the training course uses the calculation of the face load factor as an introduction to the more detailed theory of contact pattern calculation. The course explains essential issues such as modeling and stiffness, and also goes into detail about how to check and interpret the results.

The second part of the course covers the special topics involved in contact analysis, such as how to take into account shaft deformation and planetary gear units. Participants will then reinforce what they have learned by using the powerful sizing and optimization functions.

Participants will not only be provided with detailed and extensive documentation during the course, but will also be given the latest software release with full functionality for a period of 30 days. Participants must bring a laptop (with a working USB port (and read/write permission)) to the course so they can perform the exercises. If necessary, KISSsoft will provide a laptop.
Topics in the "Theory" part

**Introduction to the theory of face load calculation**
- Face load factor $K_{H\beta}$ according to ISO 6336-1, Appendix E
- Taking into account manufacturing allowances in $K_{H\beta}$ calculation according to ISO 6336-1, Appendix E
- Importance of tooth pair spring stiffness
- Characteristics of tooth pair spring stiffness according to ISO 6336-1
- Use of face load factors in load spectrum calculation

![Image of face load calculation](image1)

**Theory of stiffness calculation**
- Tooth pair spring stiffness according to the Weber/Banaschek analytical method
- Importance of system, tangent and secant stiffness
- Possible methods for calculating contact stiffness
- Importance of the correction coefficient for Hertzian stiffness
- Differences to the FE approach and comparison with other programs commonly used in Germany
- Defining the slice coupling factor
- Approximation and effects of helical gear teeth
- Defining the border weakening factor and its consequences on the buttressing effect

![Image of stiffness calculation](image2)

**Interpretation of the most important results**
- Importance and interpretation of the transmission error
- Effect of transverse contact ratio and overlap ratio on the transmission error
- Identification of entry and exit impact
- Meaning of change of normal angle at the beginning of the profile modification
- How to identify and resolve numerical problems
- Importance and interpretation of the progressions of normal force, stress, and kinematics
Topics in the "Extended Contact Analysis, Planetary Systems, Sizing and Optimization" part

Extended contact analysis
- Defining the gear/planetary gear unit coordinate systems
- Defining the shaft coordinate system
- Importance of the inclination/deviation error of axis
- Taking the shaft calculation into account
- Problems of consistency in the shaft calculation
- KISSsys as an effective data management tool for designing/analyzing entire multi-stage drives

Contact analysis with planetary gear units
- Analytical model for planetary gear unit calculation
- Options and limits of planetary gear unit calculation
- Importance of calculating iterative load distribution
- Importance and correct configuration of axis alignment

Contact analysis with bevel gear units
- Analytical model for bevel gear unit calculation

Interpretation of the most important results for planetary gear units
- Meaning and interpretation of planetary stage transmission error
- Load distribution for planets

Sizing and optimization of modifications
- Defining profile and tooth trace modifications and their effects
- Sizing and optimizing modifications manually
- Sizing and optimizing modifications for load spectra
- How to use modification sizing effectively
- How to use iterative wear calculation