KISSsoft
Drivetrain Design Solutions

Plastic Gears and Engineering

Nowadays, gear units are increasingly manufactured from plastic materials. In many cases, plastic materials can be a suitable alternative to steel.

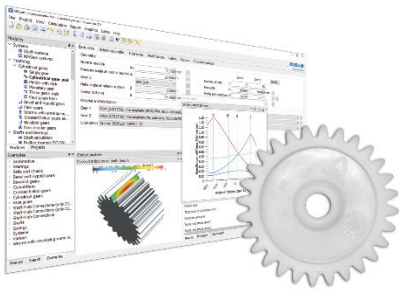
The strength of plastics depends significantly on the temperature, so determining material properties – which are needed for designing gears – require a lot more time and effort than for steel gears.

Calculation for plastics

- For cylindrical gears and worm wheels
- Shear and pitting strength calculation
- Wear calculation according to Pech

The VDI 2736 guideline has been published in 2014. The guideline, which has been updated to match the current state of technology, now also includes a flank wear calculation for cylindrical gears.

Part 2 (Cylindrical Gears) and Part 3 (Worm Wheels) of the VDI 2736 have already been implemented and are available in KISSsoft alongside the old VDI 2545.



For worm wheels, the shear strength in the root and also the pitting strength of the flank are calculated.

As a supplement to the VDI 2736 guideline, the calculation of plastic deformation and wear of plastic crossed helical gears according to Pech has been implemented.

With a new calculation module in the KISSsoft Release 03/2018, it is now possible to generate plastic material DAT files from lifetime measurements on test benches, performed according to VDI 2736 Part 4.

With this module, it is also easy to add materials to the KISSsoft database, together with the automatically generated DAT files.

Material properties of plastics

Over 55 plastic materials are available for designing gears in KISSsoft. They include materials from VDI 2545 and VDI 2736, over 20 materials from SABIC plastics, DSM and Victrex and newly added materials from a German joint venture of academic and industrial partners.

Materials range from unreinforced polyamides and polyacetal to high performance plastics with internal lubrication and carbon fiber or (long) glass fiber reinforcements.

The data in KISSsoft includes different material properties such as the temperature-dependent Young's modulus and tensile strength, and also wear for different lubrication conditions.

S-N curves (Wöhler lines)

- For fatigue strength and endurance limit
- Static values can be used
- Implementation of own material data in KISSsoft database

Conducting a series of measurements needed to determine accurate S-N curves for fatigue strength and endurance limit calculations is extremely time-consuming, so these properties are not available for all plastic materials in KISSsoft.

However, to a great extent, it is also possible to use the static strength for sizing plastic gears. As soon as properties for the fatigue strength and endurance limit

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calculations are available, they are implemented in the KISSsoft database.

Plastic toothing

- Sizing acc. to static strength
- Tooth flank wear
- Dry running and lubricated gears

In precision engineering, many applications using plastic gears have a relatively small continuous torque, but must, at the same time, also be able to transfer a high static torque – for example, when the seat adjustment mechanism in a car runs against the block. Such gears can be designed according to their static strength.

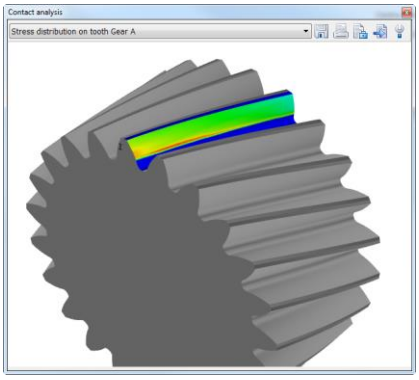
In gear units for medicine or food industry, plastic gears are often not allowed to contain any lubricant. In such cases, the wear of the tooth flank is the main criterion for failure.

Contact analysis

- Wear calculation under load
- Graphics of normal force, temperature
- Distribution of Hertzian pressure

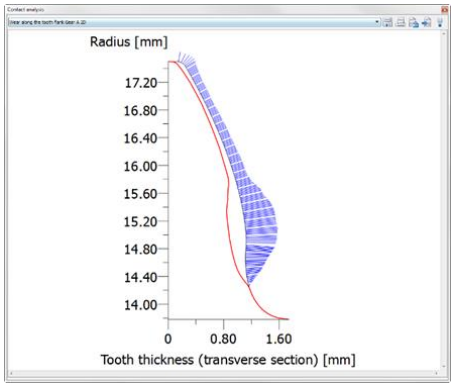
It is also possible to calculate the wear over a grid of meshing positions and facewidth using KISSsoft's contact analysis. This functionality accurately takes into account any mounting errors and flank modifications.

Other graphics show the normal force during meshing, the temperature and the stress in the root area, and also the distribution of the Hertzian pressure on the tooth flank.



Flank wear calculation

A progressive wear method is used in KISSsoft to calculate the flank wear, if the wear coefficient kw of the corresponding material is known. The method is based on the contact analysis and uses an iterative process to simulate the actual wear.



Wear is displayed either in 2D or in 3D and can provide a clear evaluation of the various modifications involved, for example, the effect of tip relief on the wear behavior.

KISSsoft performs a service life calculation by comparing the cumulated wear removal over the service life with the permissible wear. These wear properties are very helpful for designing dry running gear units and, when combined with the KISSsoft calculation software, produce results and service life values that are close to reality.

Engineering and consulting

KISSsoft AG's services also include engineering and consultation. Our experts provide you with individual support while you are designing your products. They can be your partner throughout the development and help you to optimize your product. Our areas of expertise and experiences are based on a large range of projects, which were successfully completed for clients in different industries (automotive, medicine …).

If you are interested in acquiring a test license, please contact us at info@KISSsoft.AG