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Engineering | Education | Software

Palloid spiral bevel gears

1 Calculation of palloid spiral bevel gears in KISSsoft, including rough sizing procedure

1.1 Executive summary

In the palloid spiral bevel gear, the normal module is constant over the whole face width due to the involute shape of the gear in its width direction (of course, the profile is also involute). Therefore, using the transverse module on the inner and outer diameter mte and mti respectively, the true helix angles on the outside and inside can be calculated. The values can then be used for a more precise rating in KISSsoft.
Below, the rating and rough sizing of a palloid spiral bevel gear in KISSsoft is shown.

1.2 Table of content

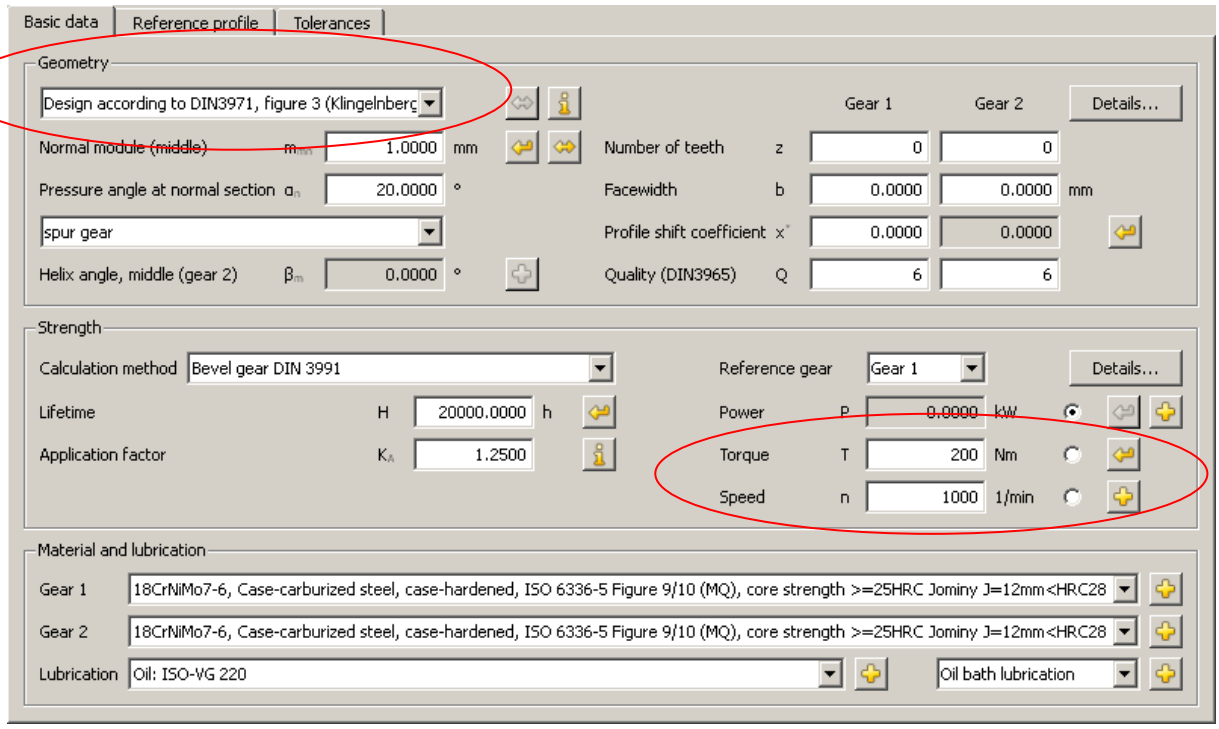
1.3 Document change record

Revision	Dated	Who	Comments
0	13.7.08	HD	Original document

2 Using KISSsoft

2.1 Enter basic data

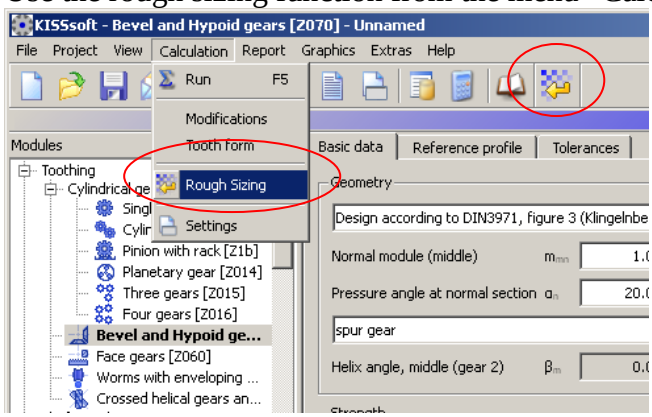
First, choose “Deisgn according to DIN3971, figure 3 (Klingelnberg” in Tab “Basic data”, field “Geometry”:



Then, enter load data, e.g. torque of 200Nm and speed of 1000RpM (on pinion) as shown above. Furthermore, choose appropriate material and lubrication condition, define required lifetime and application factor. These values will then be considered in the rough sizing as shown below.

2.2 Rough sizing

Use the rough sizing function from the menu “Calculation” or press the respective icon:

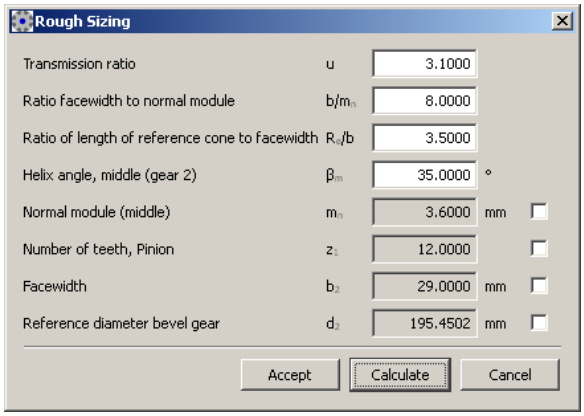


Enter the following data

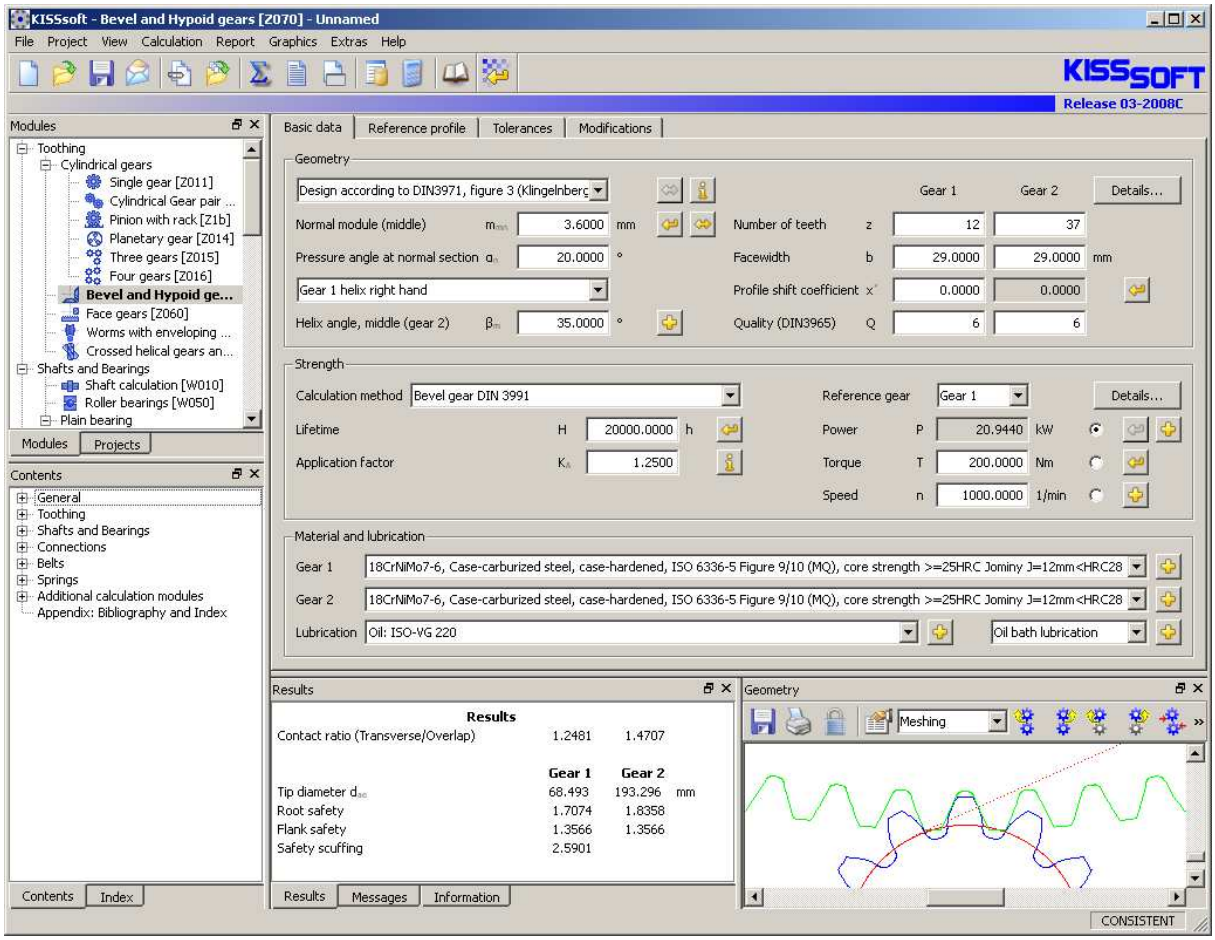
Desired ratio	as per requirement
Ratio b/mn	8…9 for smaller module and lower noise 8 as default

	7…8 for larger module and root optimized sizing
Ratio Re/b	3.5 as default
Helix angle gear 2	20°…35°

Then press “Calculate” and “Accept”:



Giving you the gear data in the main window as shown below:



2.3 Definition of outer and inner helix angle

In the report in section 8, you will now find that normal module is not equal on inside and outside ($m_{ne} \neq m_{ni}$). But as it is a palloid gear, mne and mni should be equal. We now have to find the corresponding spiral angles for inner and outer diameter such that mne=mni results.

Go to report and refer to section 8, look for mte and mti (transverse module outside and insie):

8. CONE GEOMETRY

Helix angle outside (°)	[betae]		35.0000
Helix angle in middle (°)	[betam]		35.0000
Helix angle in inside (°)	[betai]		35.0000
Normal module outside (mm)	[mne]		4.2077
Transverse module outside (mm)	[mte]		5.1367
Normal module inside (mm)	[mni]		2.9923
Transverse module inside (mm)	[mti]		3.6529
Dimensions (mm):	[dae]	68.493	193.296
(mm)	[dam]	59.590	165.697
(mm)	[dai]	50.687	138.097
(mm)	[dal]	61.641	191.086

Calculate the spiral anlges using:

$$\beta_{e,i} = \arccos\left(\frac{m_n}{m_{te,i}}\right)$$

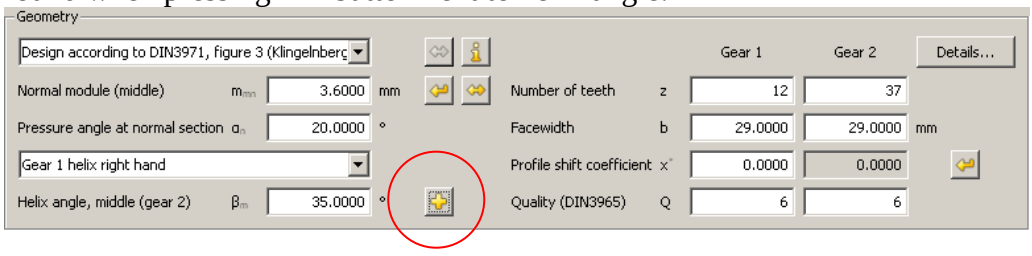
Where mn is constant ($m_{ne}=m_{ni}$) over the face width, e indicates outer diameter and i indicates inner diameter

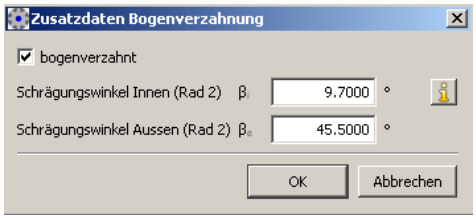
In our example, the values are:

$\beta_e = \arccos(3.6/5.1367) = 45.5°$

$\beta_i = \arccos(3.6/3.6529) = 9.7°$

These values can now be entered in the window “Additional data for spiral teeth”, which is found when pressing “+” button next to helix angle:





If the calculation is now repeated, mne is now equal to mni (execute calculation and see report, section 8):

8. CONE GEOMETRY

Helix angle outside (°)	[betae]		45.5000
Helix angle in middle (°)	[betam]		35.0000
Helix angle in inside (°)	[betai]		9.7000
Normal module outside (mm)	[mne]		3.6004
Transverse module outside (mm)	[mte]		5.1367
Normal module inside (mm)	[mni]		3.6006
Transverse module inside (mm)	[mti]		3.6529
Dimensions (mm):	[dae]	71.978	192.072

Now, mne and mni (normal module outside and normal module inside) are identical.
This shows that palloid gears can be calculated using KISSsoft.