Tutorial for gear design and calculation with MDESIGN gearbox

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Conclusion

This is a guide for generating a gear model and subsequent recalculation of the kinematics and the single parts with the software “MDESIGN gearbox”.
In little steps will be illustrated how to design a 3D-modell of a single-stage spur gear unit and described how to check this construction. Additionally it will show how to get documented investigative results.

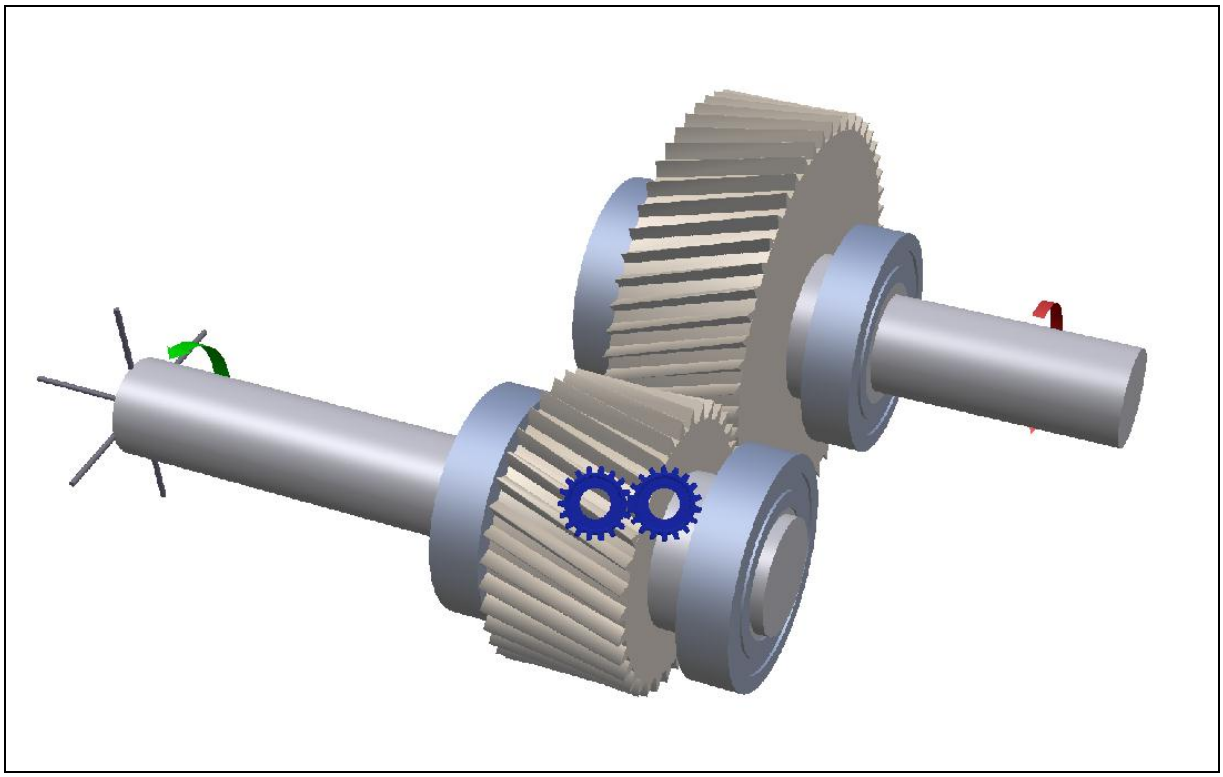


Figure 1: Example of an spur gear in MDESIGN gearbox

1. Index

2. Basic settings for calculation

Start the software MDESIGN and open in the left content-menu the folder MDESIGN gearbox and choose the entry MDESIGN gearbox with double-click.

Start a new project by clicking on data → new →reset. All data on the input page will be set on default values.

Choose in the topic “Choice calculation” → “Calculation”.

Save the dataset gearbox (*.xml) into a variable folder. You are now working with this dataset and can change it by pressing “save” again.

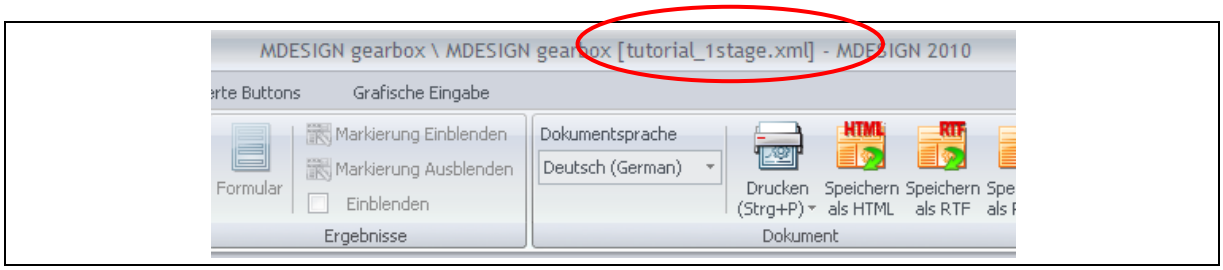


Figure 2: Active dataset

Now change to the graphical input interface. Therefore choose in the pull-down-menu the entry graphical input.

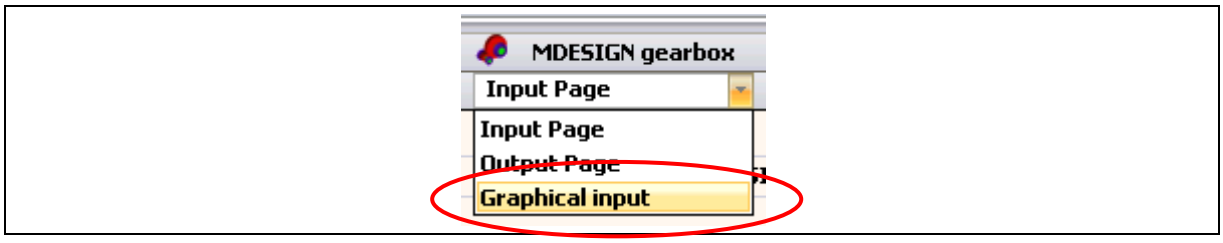


Figure 3: Choose graphical input

On top of the working frame you can find the toolbar for the graphical input.

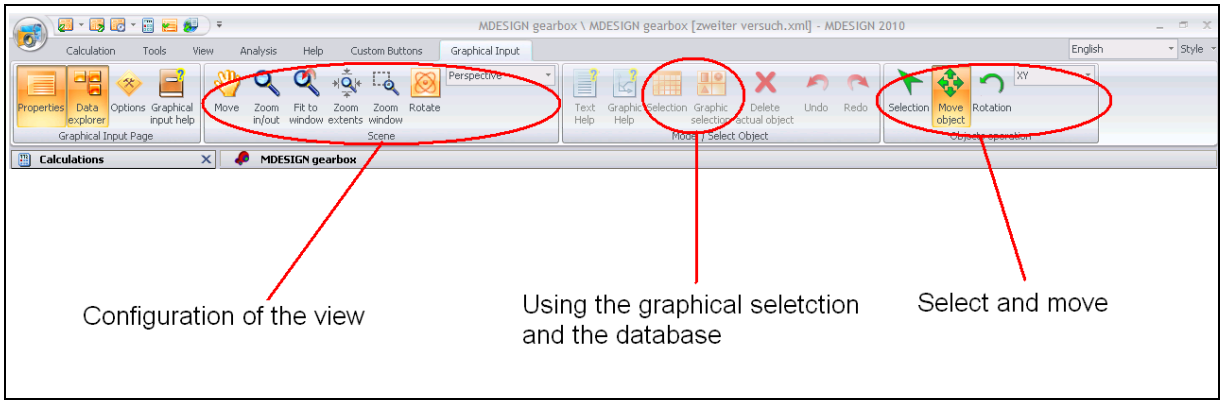


Figure 4: Toolbar

In the Graphical input you will find different categories. The frame in the middle, where the coordinate system is shown, is the design space of your gearbox. The menu on the right is the element explorer, where you can select the required machine elements. The menu on the left side shows the properties of the selected element.

At the bottom you find graphic and text helps, which should make the handling with the software more easily. In the toolbar you can find on the right the column objects operation. There you can chose to select parts or move them in the 3D-view. On the left of it is the column model / select object. It allows you to specify your machine parts with information from the database or by graphical selection.

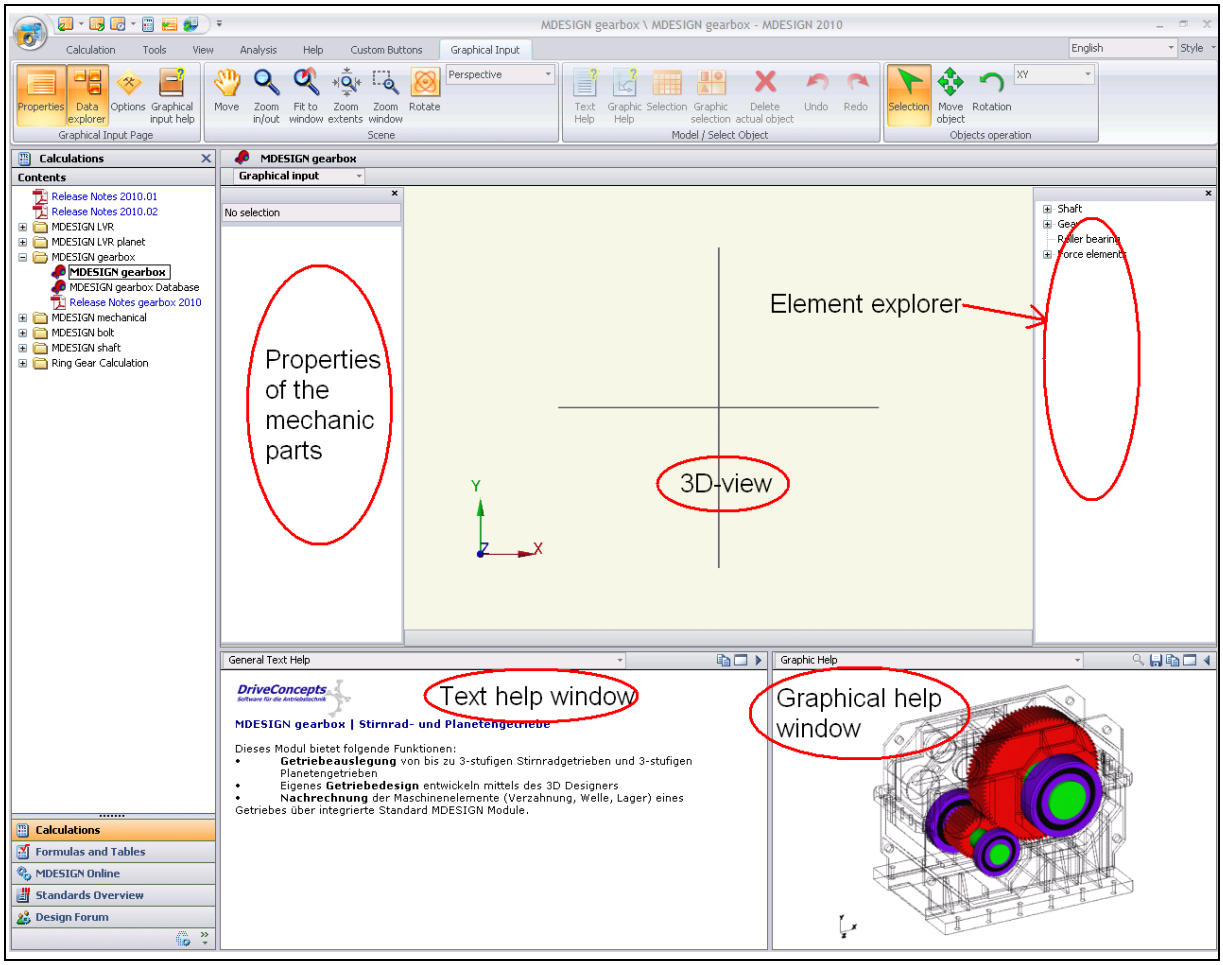


Figure 5: Areas in the graphical input

Before you start with the modeling, change back to the Input Page. In the topic materials you can find two tables where you can choose the material for the gearwheels and shafts. Therefore press the database-symbol on the right side over the tables and chose MDESIGN- or user-database.

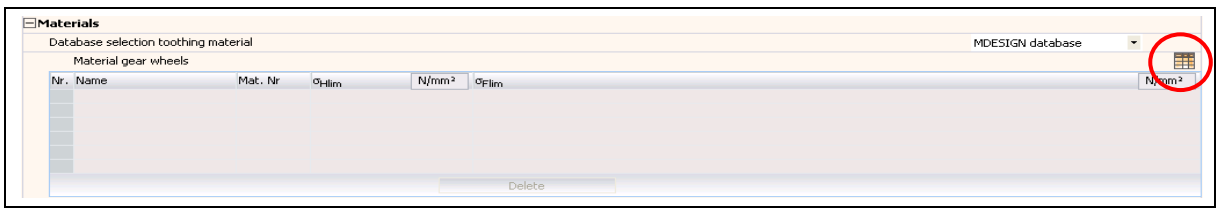
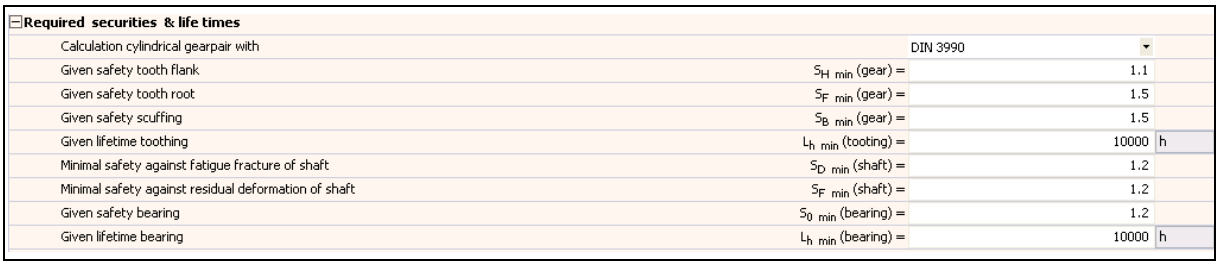


Figure 6: Material selection

It appears a list with standardized materials from the MDESIGN database. For the gearwheels chose 16MnCr5 and for the shafts again 16MnCr5 and E295. Repeat the same procedure for the lubrication and chose “Oel1”.

Now you see in the tables the chosen materials and lubricant. For modifications of the database entries you can use the module MDESIGN gearbox database.

Next choose circular lubrication for the gearbox. In the topic “Load data” enter for KA = 1.1 and KAS 1.5. The required securities and live times should be preset like in the following graphic:



Required securities & life times			
Calculation cylindrical gearpair with		DIN 3990	
Given safety tooth flank	$S_{H\ min}$ (gear) =	1.1	
Given safety tooth root	$S_{F\ min}$ (gear) =	1.5	
Given safety scuffing	$S_{B\ min}$ (gear) =	1.5	
Given lifetime toothing	$L_{h\ min}$ (tooting) =	10000	h
Minimal safety against fatigue fracture of shaft	$S_{D\ min}$ (shaft) =	1.2	
Minimal safety against residual deformation of shaft	$S_{F\ min}$ (shaft) =	1.2	
Given safety bearing	$S_{0\ min}$ (bearing) =	1.2	
Given lifetime bearing	$L_{h\ min}$ (bearing) =	10000	h

Figure 7: Definition of required securities and live times

Go back to the graphical input.

3. Modeling the gearbox

3.1. Modeling the shafts

In the graphical input are shafts modeled by single parts. Therefore you have to click in the element explorer → "Shaft" → "Shaft section" and drag it with pressed mouse button in the 3D-view. By selecting a part you can see the properties in the left menu. da_l and da_r represent the left and right outer diameter as well as di_l and di_r are for the left and right inner diameter. Enter the following parameters for the first part.

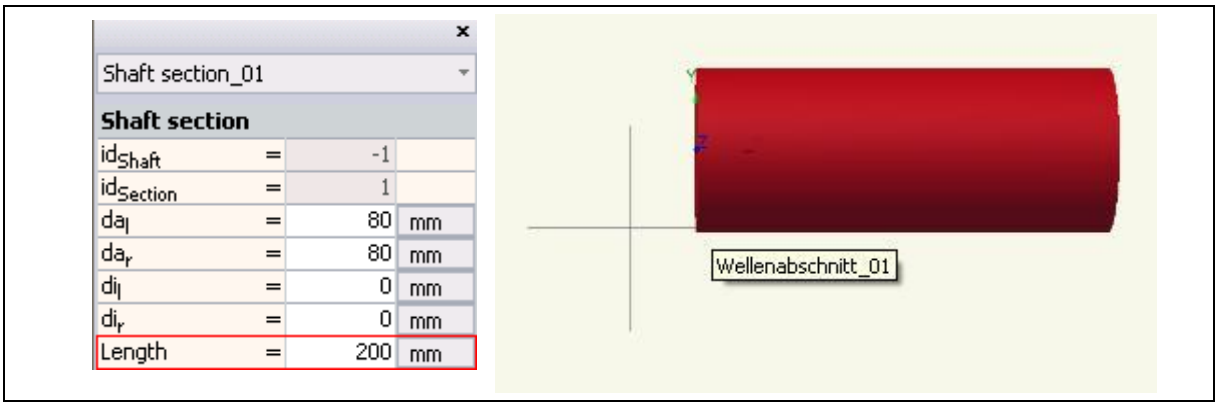


Figure 8: Definition of a shaft

The shafts in this example are solid shafts. So the inner diameter is always zero. Now the first shaft section must be spatial arranged by using snap layers. Click in the column objects operation on the button Move objects. If you drag the "Shaft section_01" by pressing the mouse button continuously, you will see on the face surface yellow snap layer.
Move the shaft section to the black cross. When the snap layer changes it color to blue, the software detected the composition and connects the shaft with the cross, when you release the mouse button.

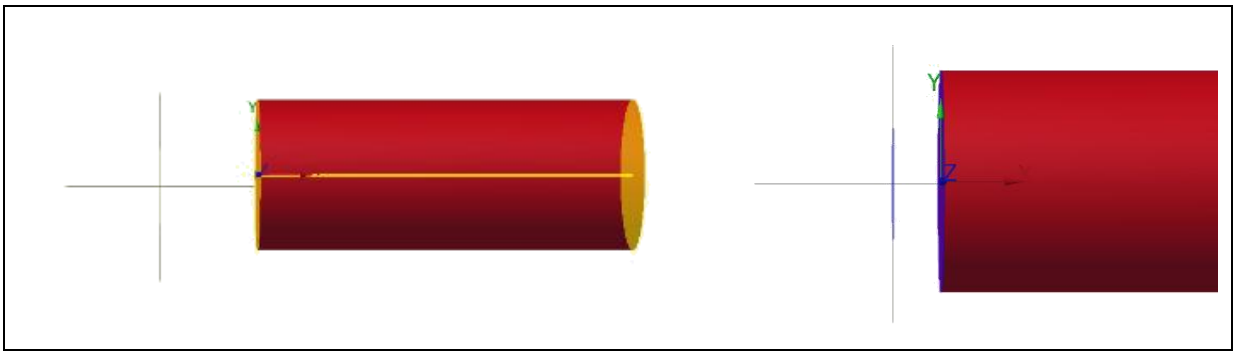
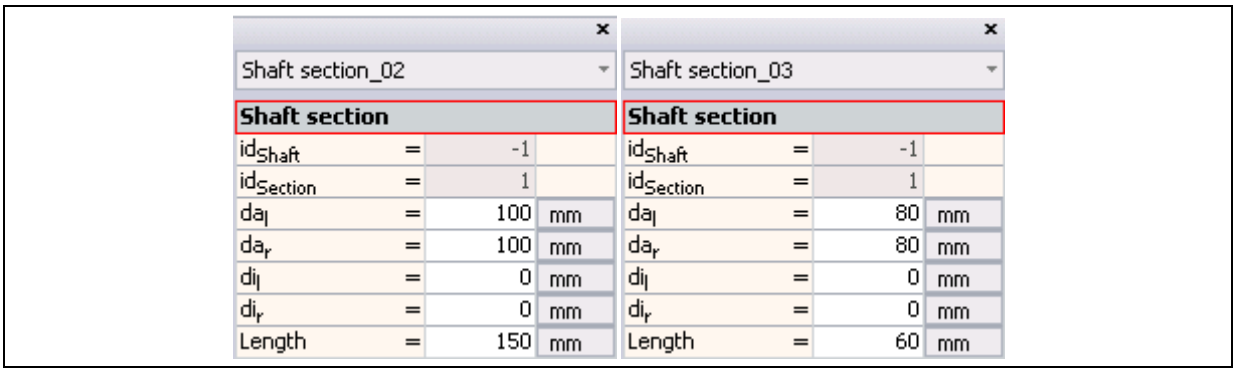


Figure 9: Snapping the first shaft section at the assembly center

Now create two more shaft section. Connect them on the right side of the first shaft and use the following parameter for the sections.



Shaft section_02

Shaft section			
id_{Shaft}	=	-1	
$id_{Section}$	=	1	
da_l	=	100	mm
da_r	=	100	mm
di_l	=	0	mm
di_r	=	0	mm
Length	=	150	mm

Shaft section_03

Shaft section			
id_{Shaft}	=	-1	
$id_{Section}$	=	1	
da_l	=	80	mm
da_r	=	80	mm
di_l	=	0	mm
di_r	=	0	mm
Length	=	60	mm

Figure 10: Properties of shaft section two and three

After the sections are connected you can select them by pressing “Strg” and “left mouse button”.

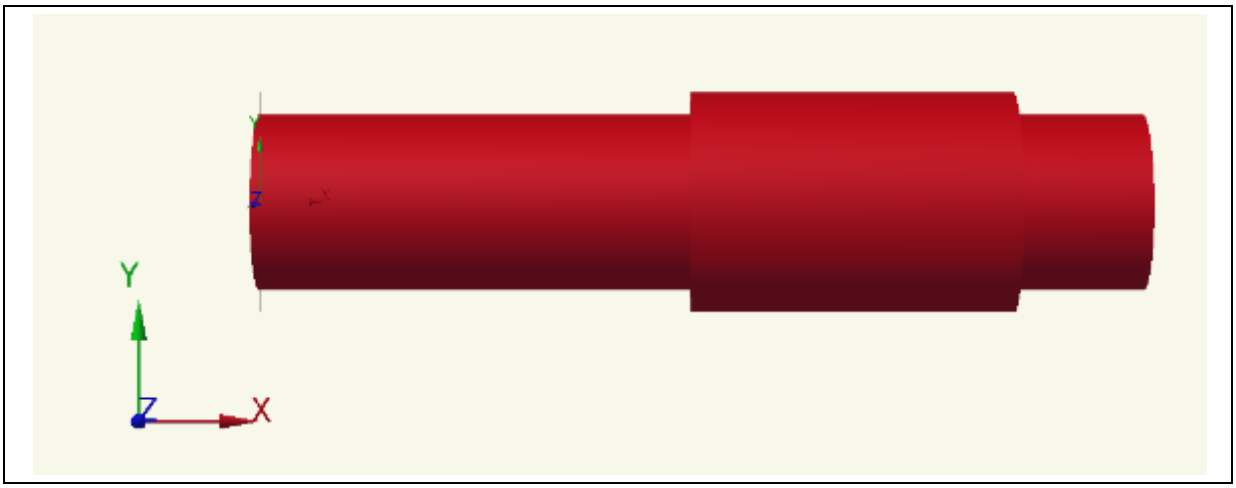


Figure 11: Appearance of the first shaft

To move component assemblies with the belonging coordinate system use the middle mouse button. In addition you can zoom with the mouse wheel. After selecting the whole shaft, you can choose the shaft material. Therefore mark the entry material in the properties and click on the button Selection in the model / select object column. Now you can choose one of the defined materials. Because “Welle_01” will be a bevel shaft use the material 16MnCr5.
Due a double click the 2D shaft editor of the shaft calculation appears. Here it is possible to add and remove shaft sections and additional forces and notches.

Now create the second shaft on your own with the following dimensions in mm:

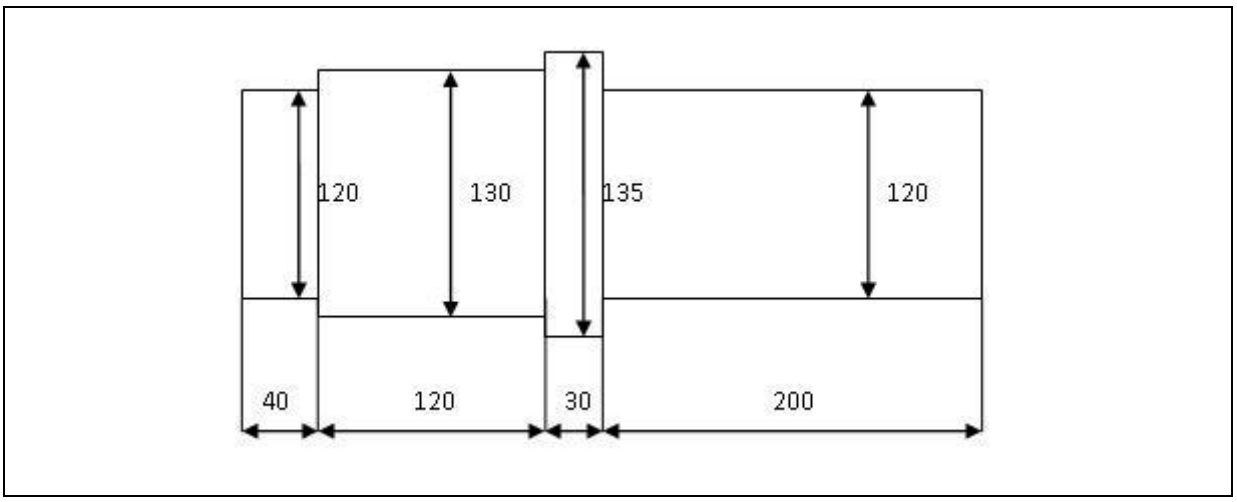


Figure 12: Dimensions of the second shaft

The first section of the “Welle_02” can be placed everywhere on the screen. The position will be specified later by connecting the spur gears. Try to build the shaft from left to right it will make it easier to position the spur gear later. Don’t forget to specify the material of the second shaft, it should be E295.

Now you should have two shafts like in the picture below.

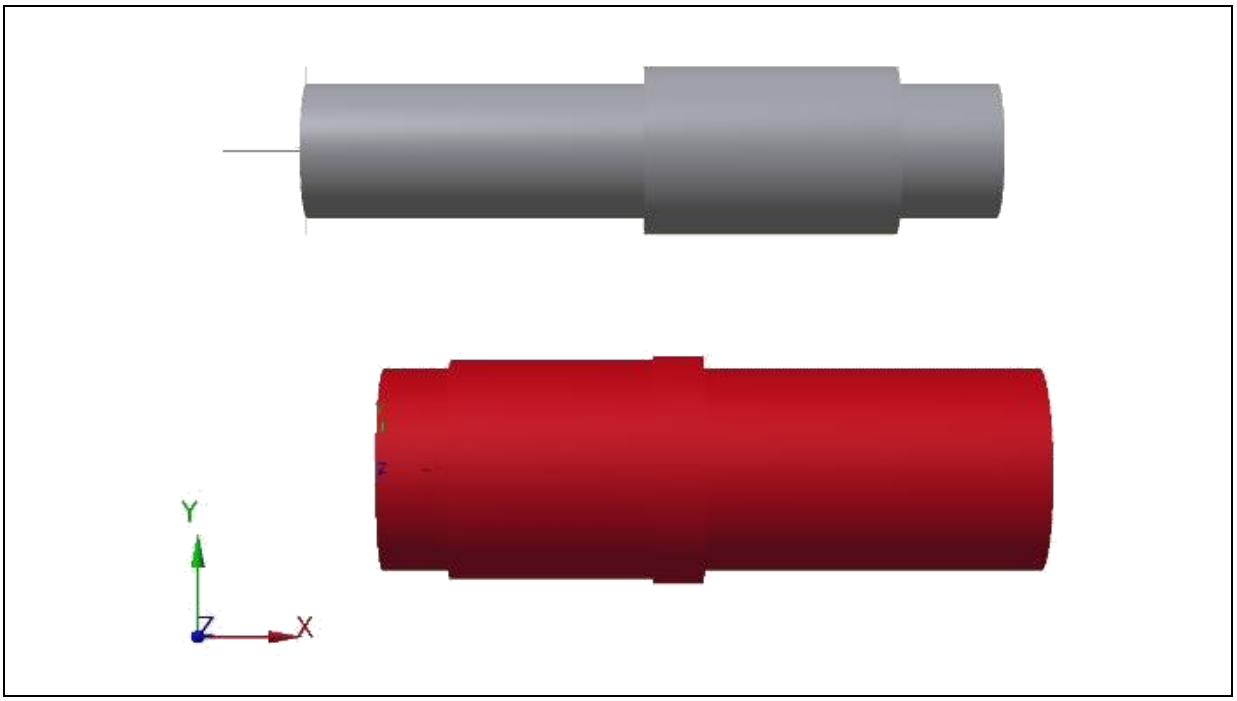


Figure 13: Design of the second shaft

Tip: By clicking on a graphical element with the second mouse button it is possible to change the color settings.

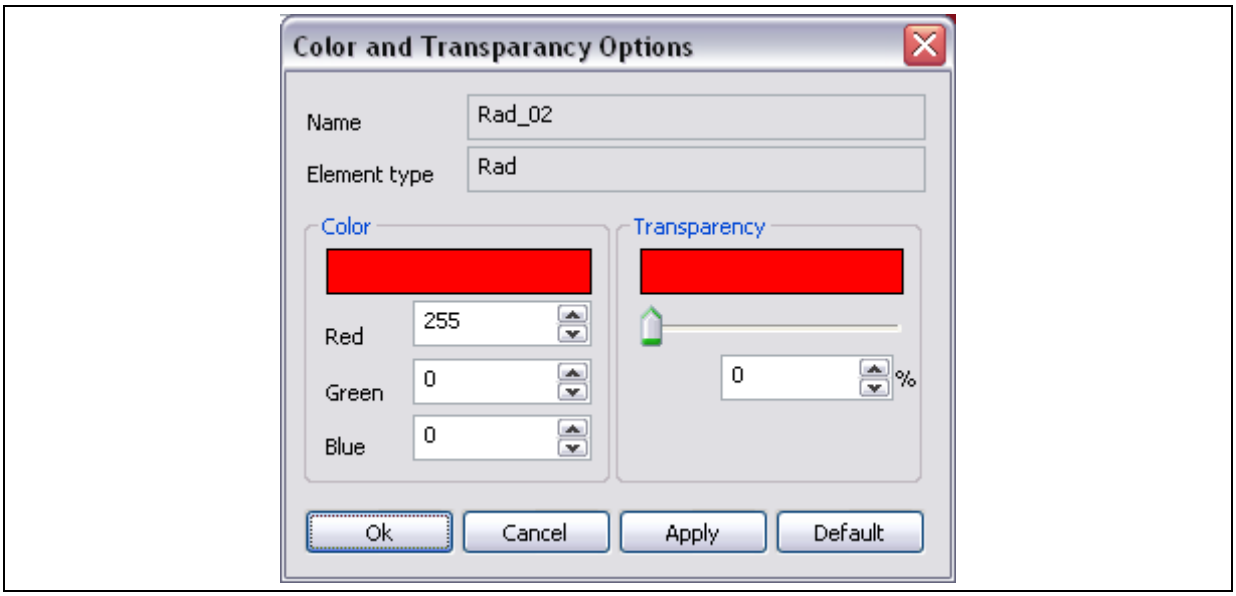


Figure 14: Color settings of an element

3.2. Design of spur gears

Spur gear can be modeled similar. Choose in the element explorer “Gear” → “Spur gear” → “External gear” and drag it into the 3D-view. Then select it to specify the bevel.

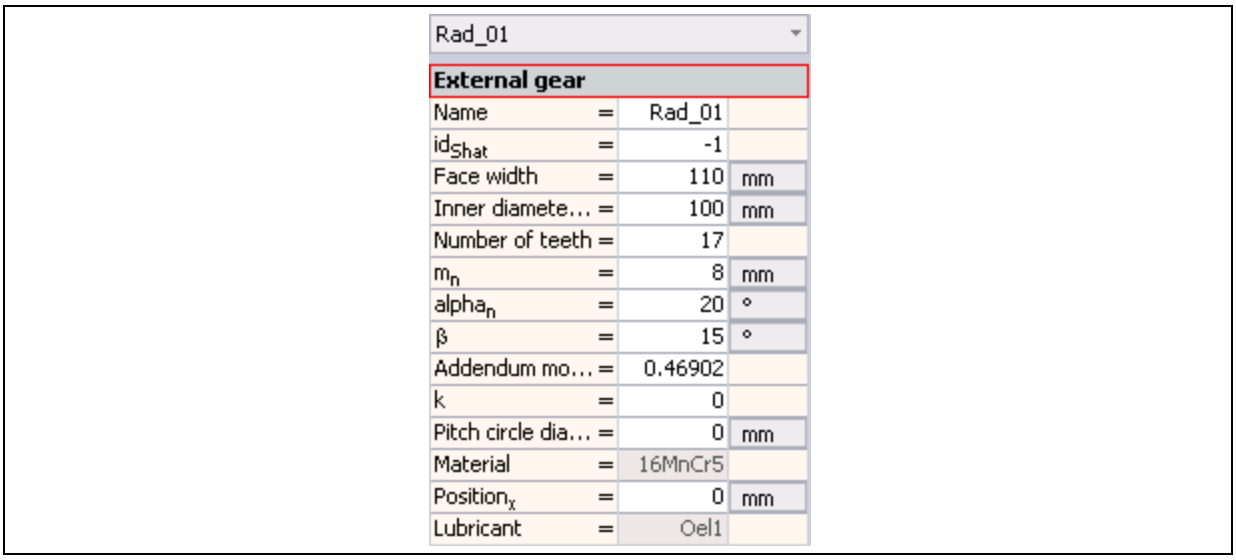


Figure 15: Specifications of the bevel

Material and lubrication can be defined like described before. If you move the bevel you will see a yellow snap line in the bevel and also on the shafts. Place the bevel on the “Welle_01” until the snap line turns blue and release it.

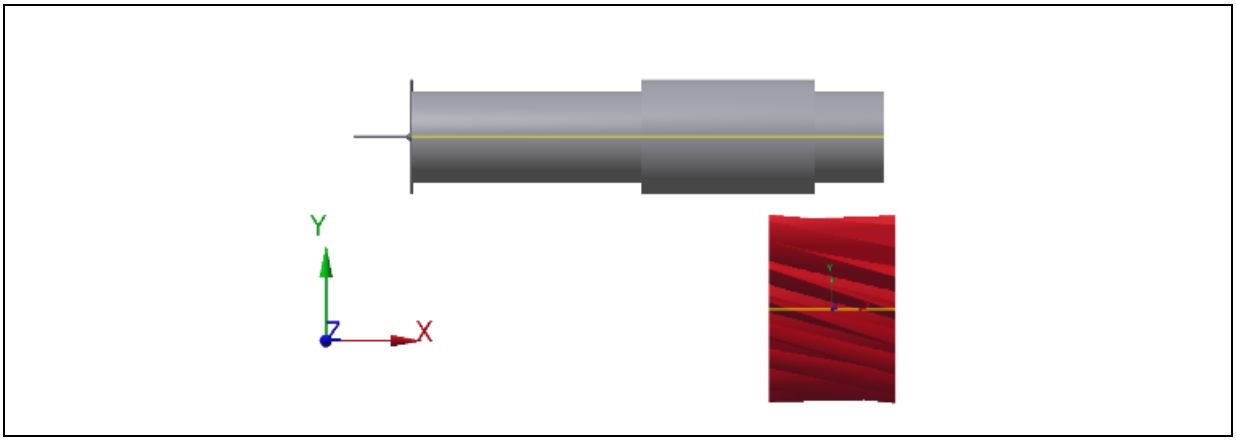


Figure 16: Detect possible snap lines

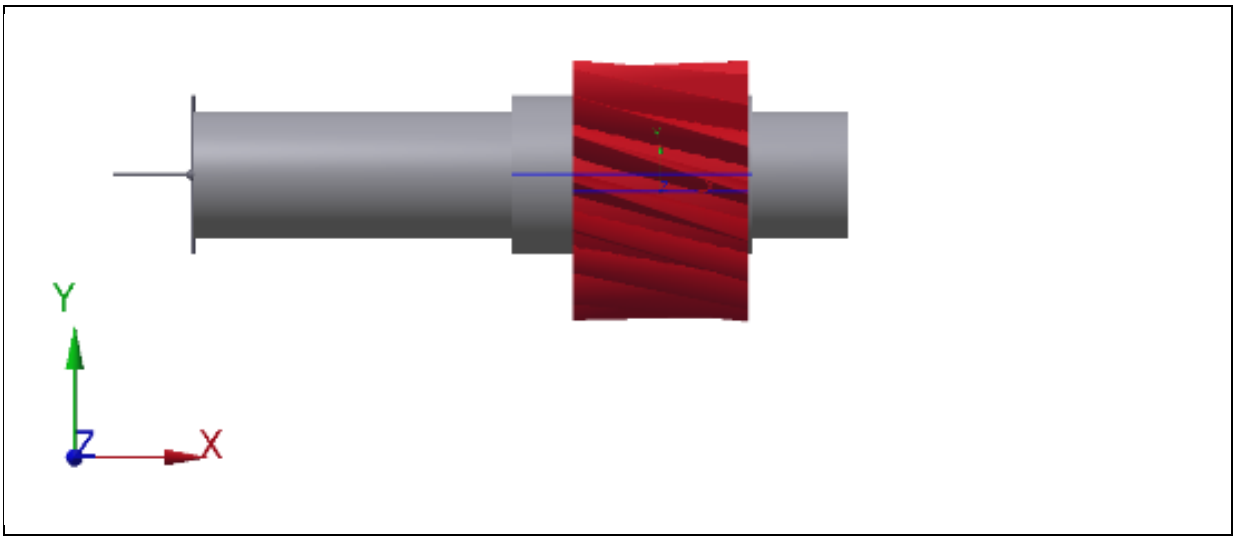


Figure 17: Snapping the gear on the first shaft

The rotation axes are now associated but the position of the X-coordinate must be firmed. Therefore select the bevel and type in line $Position_X$ the quality 275. The X-offset is always the distance from the shaft-origin to the middle of the gear.

Place a second gear on the "Welle_02" with following parameters.

External gear			
Name	=	Rad_02	
id_{Shat}	=	-1	
Face width	=	108	mm
Inner diameter...	=	130	mm
Number of teeth	=	34	
m_n	=	8	mm
$alpha_n$	=	20	°
β	=	-15	°
Addendum mo...	=	0.46902	
k	=	0	
Pitch circle dia...	=	0	mm
Material	=	16MnCr5	
$Position_x$	=	0	mm
Lubricant	=	Oel1	

Figure 18: Properties of the second gear

The X-offset is 106 mm.

Now you have to connect the two gears. You need to select component group (“Welle_02” and “Rad_02”) by holding down the Alt-button. Do not release the button otherwise you lose the connections between gear and shaft. In the middle of the gears appears yellow snap line. If you bring them together, they will turn blue. Now release the mouse and the Alt-button.

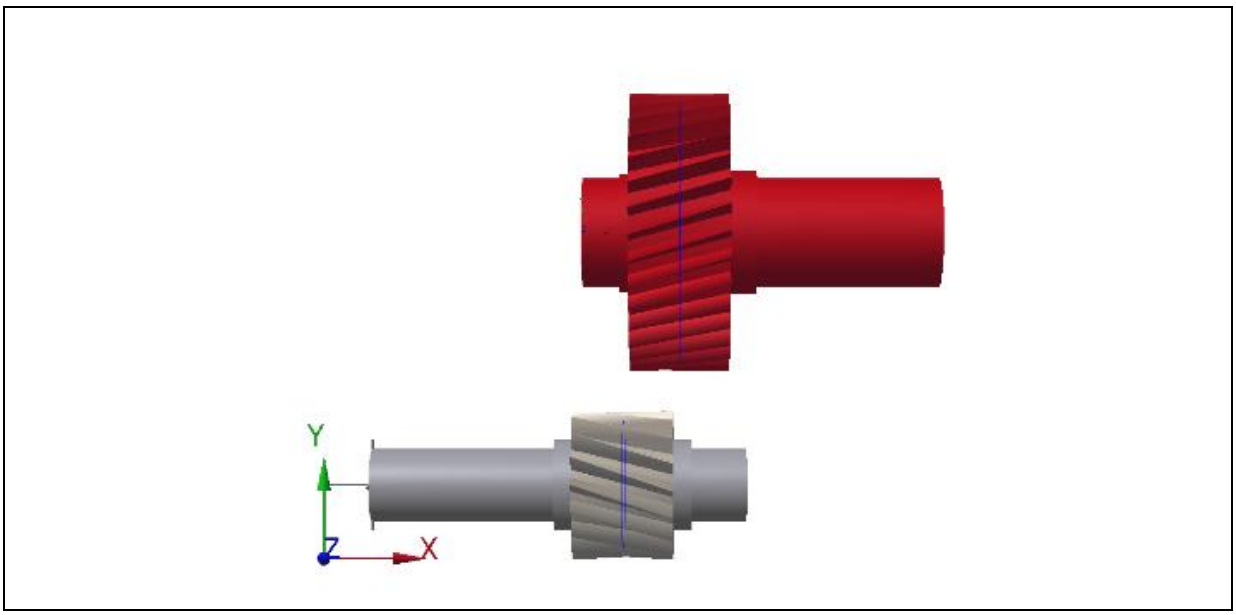


Figure 19: Snapping a gear pair

The gears are connected when a blue padlock appears.

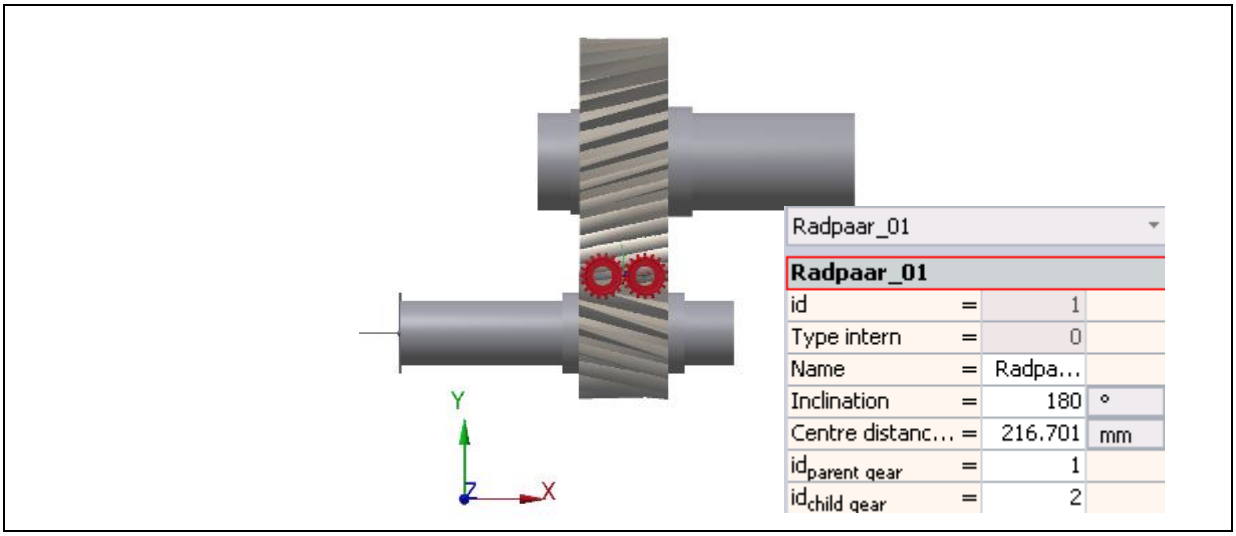


Figure 20: Definition and properties of a gear pair

3.3. Modeling of bearings

In the graphical input mode you can specify the dimensions of bearings. An exact specification is possible later. Place a bearing like before and define as below:

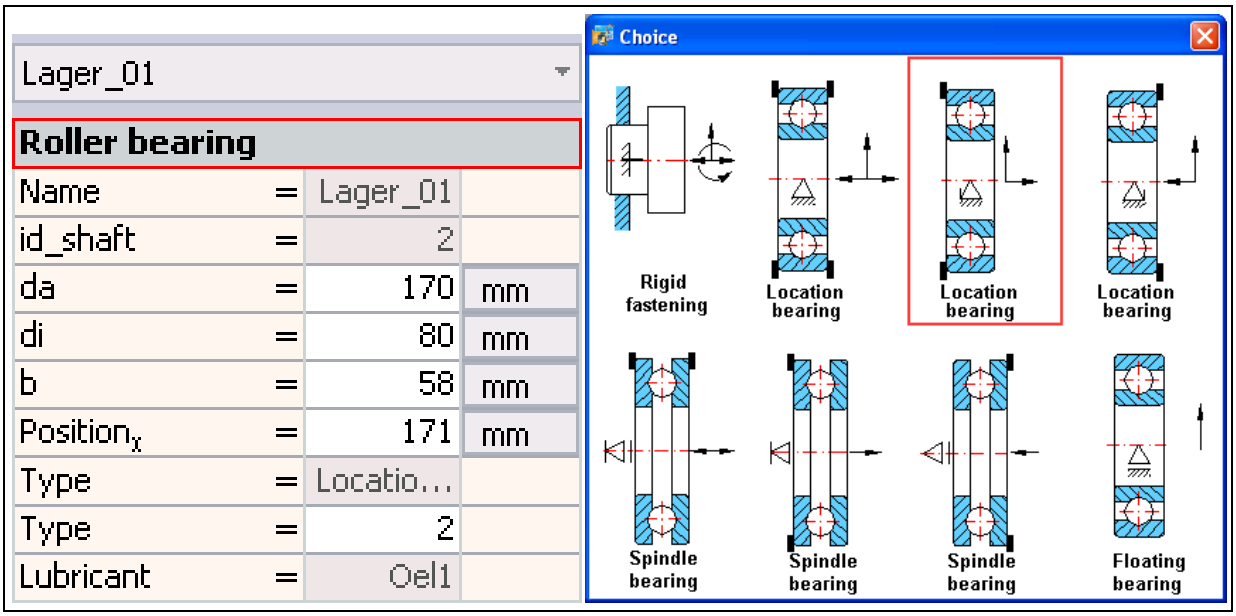


Figure 21: Specification and bearing type

The bearing type can be set by the graphic selection button. Choose in the popup window the bearing, which is fixed on the left side. Also choose the lubricant.
Like the gears, the bearings have to be placed by snapping lines on “Welle_01”. The X-offset has an amount of 171 mm.

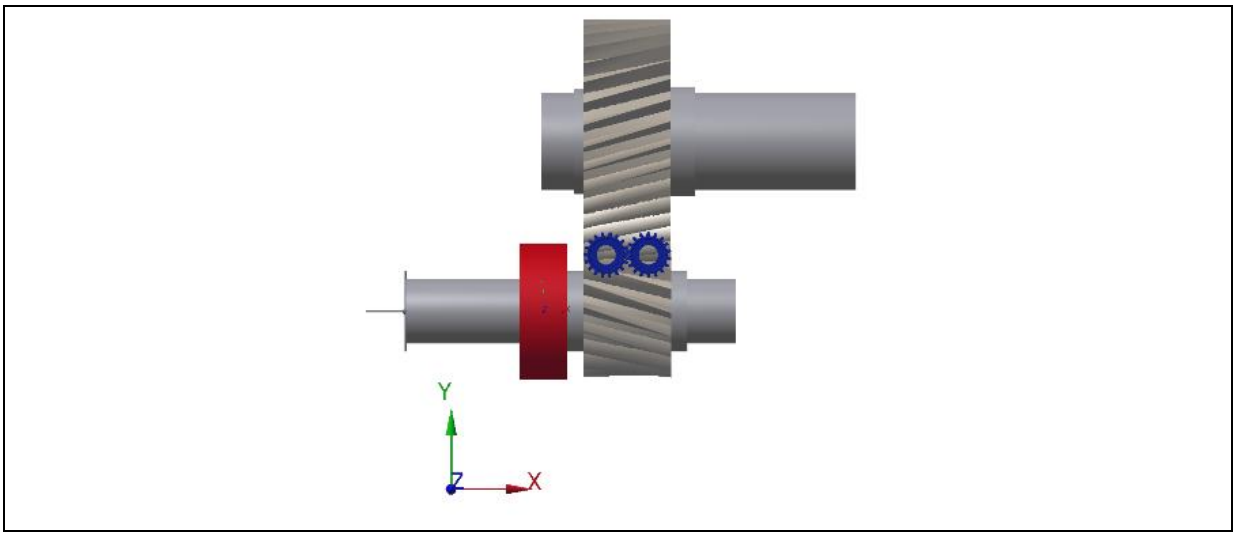


Figure 22: Placement of the first bearing

Create a second bearing with the same dimensions and place it on the other side of the bevel with an X-offset of 379 mm. This time you have to use a bearing, which is fixed on the right side, so you get a strut mount bearing.
Now you have to create both bearings for the “Welle_02”. These have different dimensions:

Lager_03				Lager_04			
Roller bearing				**Roller bearing**			
Name	=	Lager_03		Name	=	Lager_04	
id_shaft	=	3		id_shaft	=	3	
da	=	215	mm	da	=	180	mm
di	=	120	mm	di	=	120	mm
b	=	40	mm	b	=	48	mm
$Position_x$	=	19.9999	mm	$Position_x$	=	214	mm
Type	=	Festlag...		Type	=	Locatio...	
Type	=	2		Type	=	3	
Lubricant	=	Oel1		Lubricant	=	Oel1	

Figure 23: Specification bearing three and four

The second shaft will also get a strut mount bearing, so the bearing types has to be set like “Lager_01” and “Lager_02”. For the X-offset use 20 and 214 mm.

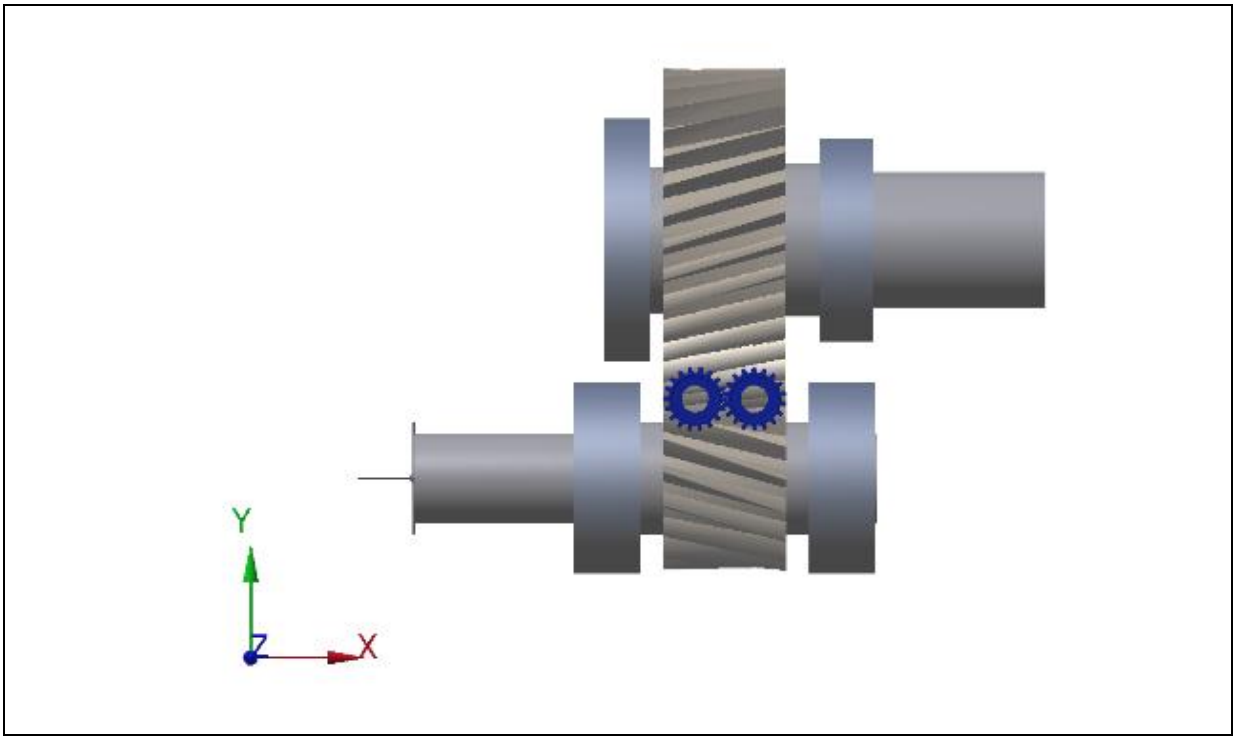


Figure 24: All bearings are in position

3.4. Modeling drive and output drive

The mechanic parts of the gear box are nearly complete configured. To start with the calculation, we have to place force elements. You can do that by select in the element explorer → "Force elements" → "Drive" and put it directly on the first shaft. It will appear as a green arrow.

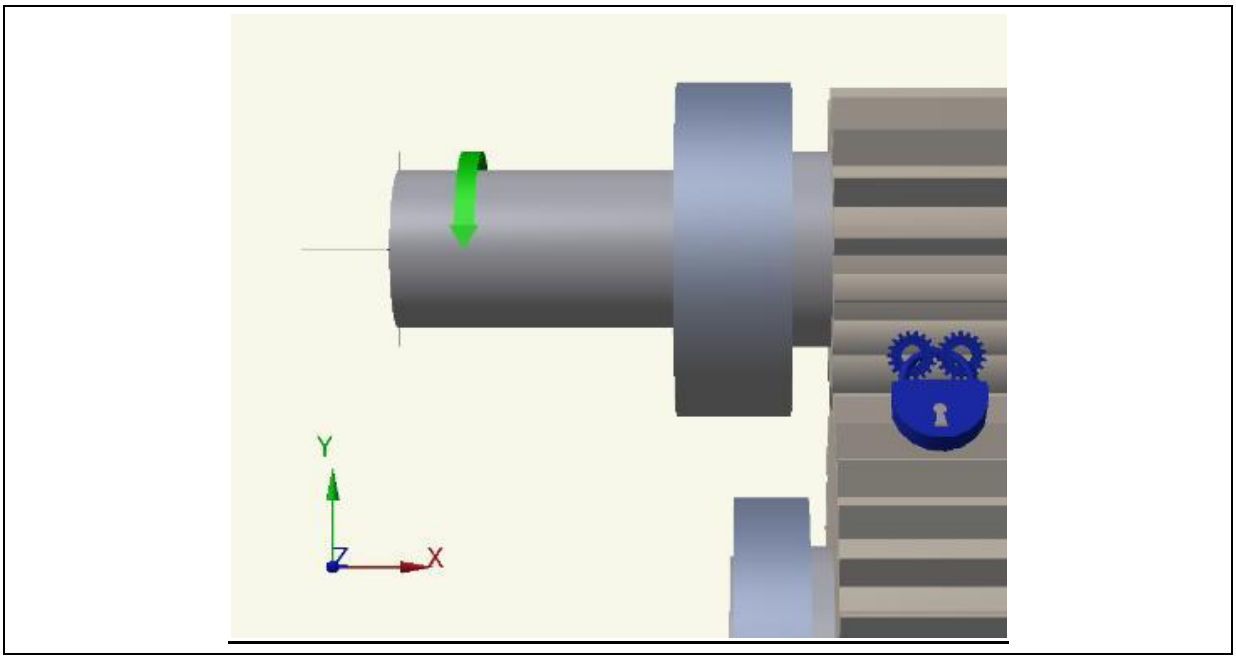


Figure 25: Placement of the drive

In the configuration menu you can decide if rotational speed and moment will be default or calculated. Therefore you can use the graphic selection.

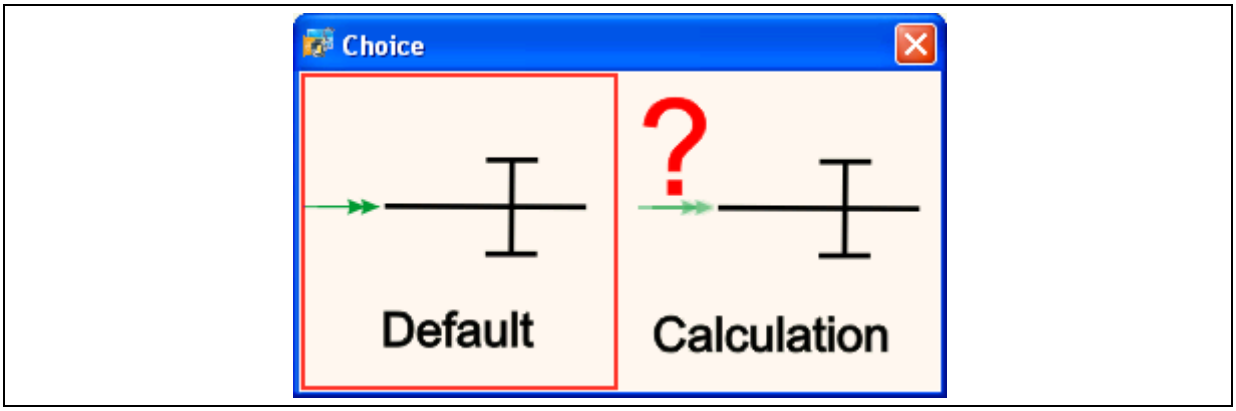


Figure 26: Default moment and rotational speed

In our example the drive has a fixed moment and rotational speed. So choose both as a default value. The algebraic sign in front the rotational speed changes the rotational direction. The torque must have a value higher than zero. The X-offset has to be 30 mm.

Antrieb_01

Antrieb_01			
id	=	1	
Name	=	Antrieb...	
id_{Shaft}	=	2	
$Position_x$	=	32.0747	
Rotational spe...	=	Default	
Moment?	=	Default	
Rotational speed	=	1000	1/min
Power	=	500	kW
Nominal torque	=	4774.65	

Figure 27: Specification output drive

Place an output drive on the right side of “Welle_02”. This time you have to set torque and rotational speed as calculated values. The X-position should be 360 mm. Now you have finished the graphic input part of our tutorial.
If you have followed all steps proper, you should have a gearbox like in the following picture:

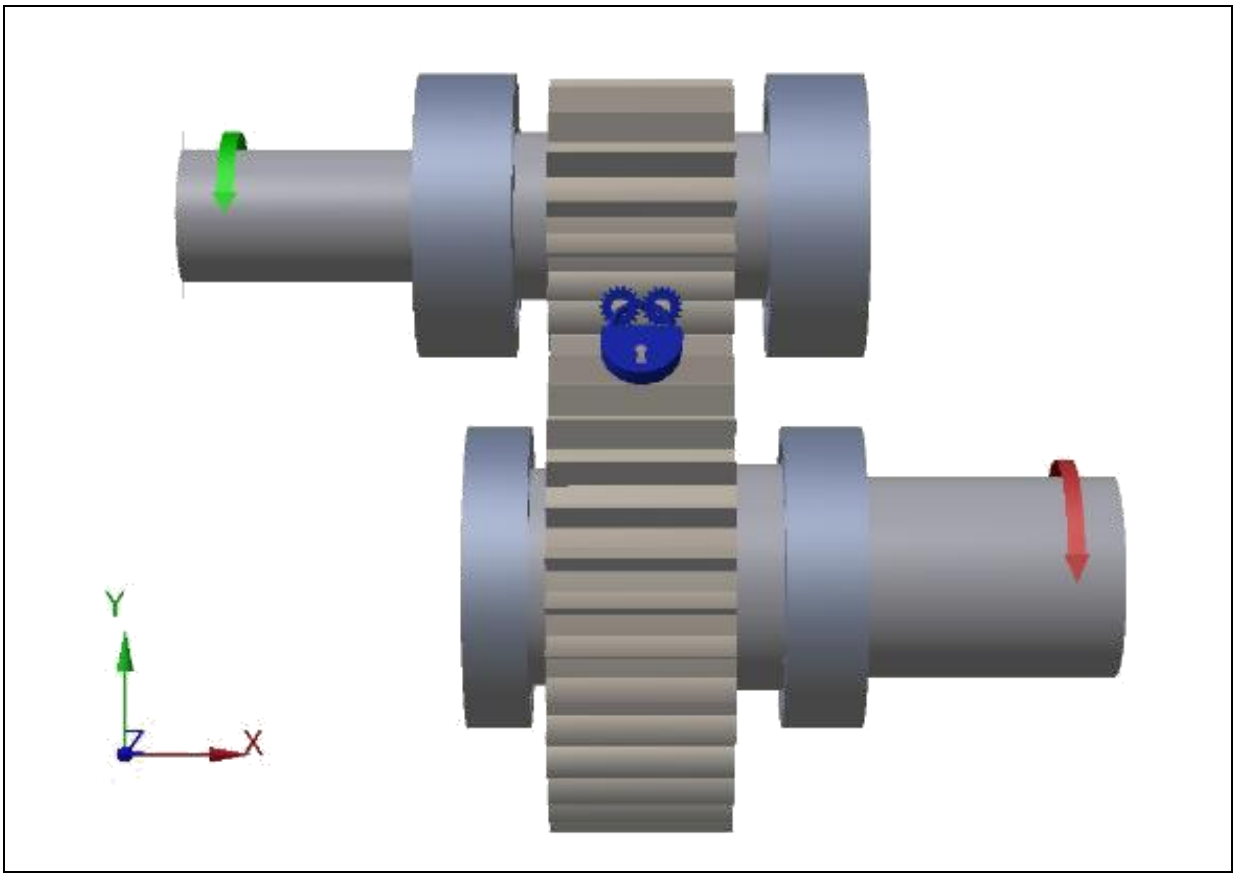


Figure 28: Final gear model

4. Calculation

4.1 Calculation of kinematics

Now change back to the input page. There you chose in the pull-down menu the entry calculation. Now the software offers three possible calculations. You can choose them in the topic “choice of level of detail of the gearbox” or in the toolbar in the column actions.

Figure 29: Chose calculation of kinematics in the toolbar

Under the topics material, load data and required securities & life times are all previous selected data present. Most of the other values are already set by the graphic input.
The only wanting data is the tooth efficiency in the topic “Advanced parameters of the chosen variant” → “Joints” → “Gear pairs”. Set the value of it to 0.99. Further entries are not required. Press F10 to start the calculation.
On the right side of the screen you can see now a window with the output page. It contains the results of the calculation (torque, rotational speed, power, transmission ratio). In the column “Document” you can document your results. The input- and calculation-data will be listed. They can be printed or saved in HTML-, RTF- or PDF-format. The document Language can be chosen in this column too.

MDESIGN gearbox | gear design

Results of recalulation

Calculation of kinematics executed successfully!

Kinematics

Drive	Driven gear	Speed [1/min]	Torque [N*m]	Power [kW]
Antrieb_01	-	1000.000	4774.650	500.000
-	Abtrieb_01	-500.000	9453.807	-495.000

Transmission ratio

relation	kinematic ratio	static ratio
Antrieb_01/Abtrieb_01	-2.000	0.505

Toothing

Gear pair	$Wheel_1$	$Wheel_2$	M_1 [N*m]	M_2 [N*m]	n_1 [1/min]	n_2 [1/min]	SH_1	SH_2	SF_1	SF_2	SB	SintB
Radpaar_01	Rad_01	Rad_02	-4774.650	-9549.300	1000.000	-500.000	-	-	-	-	-	-

Figure 30: Result of the kinematic calculation

4.2 Calculation of spur gears

Close the output page again and choose “Detailing” → “Machine elements”. It appears a selection of machine elements. Click on “Gear pair”.

Figure 31: Choose detailing

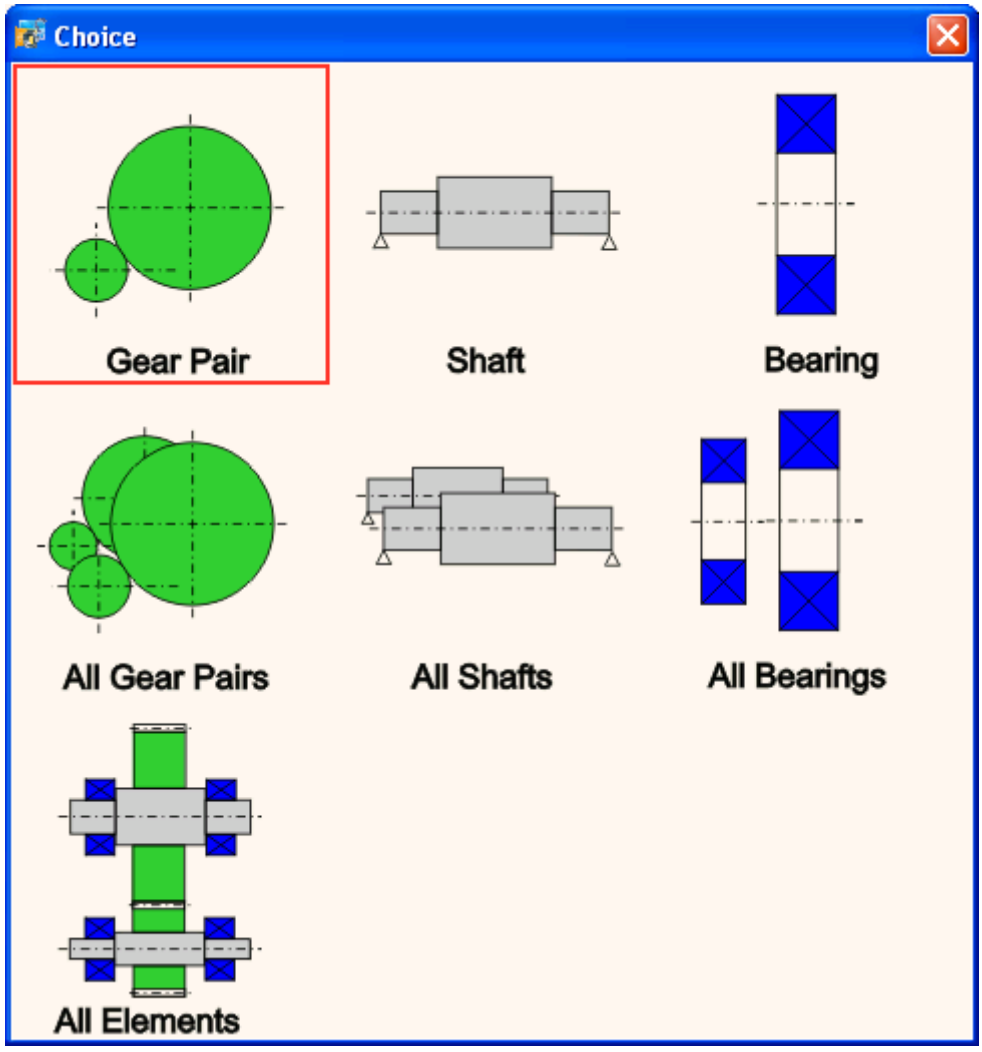


Figure 32: Choose Machine Elements

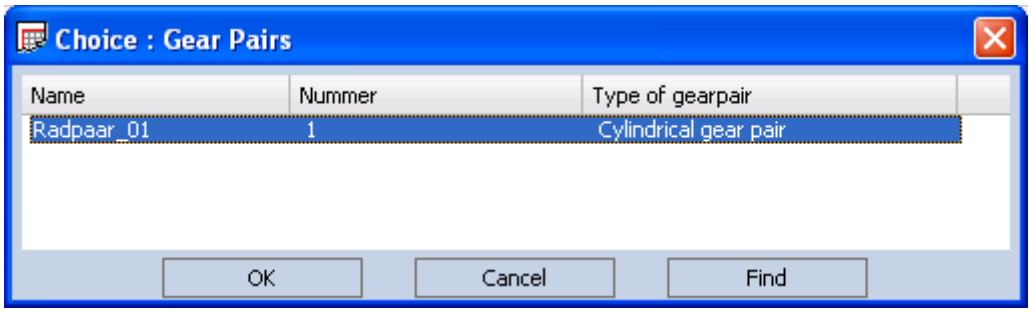


Figure 33: Selection of the gear pair

In the appearing database window can you decide between every gear pair, which are in the gear box. In our example we have only the one gear pair “Radpaar_01”. Select it and press “OK”. Now a message appears with the information that a reference profile for the gear pair is needed. Therefore select in “Advanced parameters of the chosen variant” → “Machine elements” → “spur gears” in the column “Reference profile” with the selection button a reference profile. In this case you can choose the first entry for both spur gears.

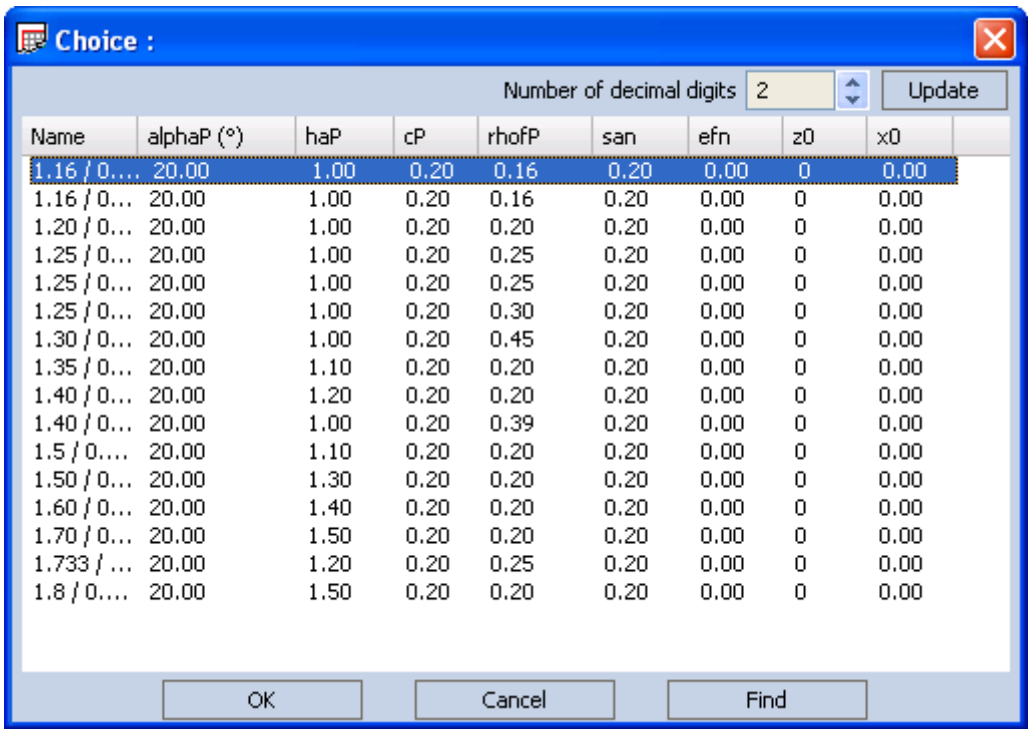


Figure 34: Selection of a reference profile

Confirm in “Choice of level of detail of the gearbox” → “Choice of elements for the calculation” the button “User function” or use the toolbar.

Figure 35: Reselection of the gear pair you like to detail

Now you can change different tooth parameters. At first set the “Centre distance” to 218 mm. In the topic “Input method topland shortening” choose “No input” in the pull-down-menu. If these factors are set to zero, the program will calculate them with a standardized method. In the next row (“Addendum modification according to DIN 3992/3993”) select for the input method again “No input” and for the optimization “Balanced toothing”. Now you can start the calculation by pressing F10. After a few seconds you can see the calculated securities of the bearings. If these are lower than your requested securities a warning will be displayed in red color on top of the output site.
In addition you can watch all calculation steps and in the graphic menu you can see different figures of your gear which can be easily saved to your hard drive. This can be for example the tooth profiles, pitting- and pitting bearing capacity diagrams.

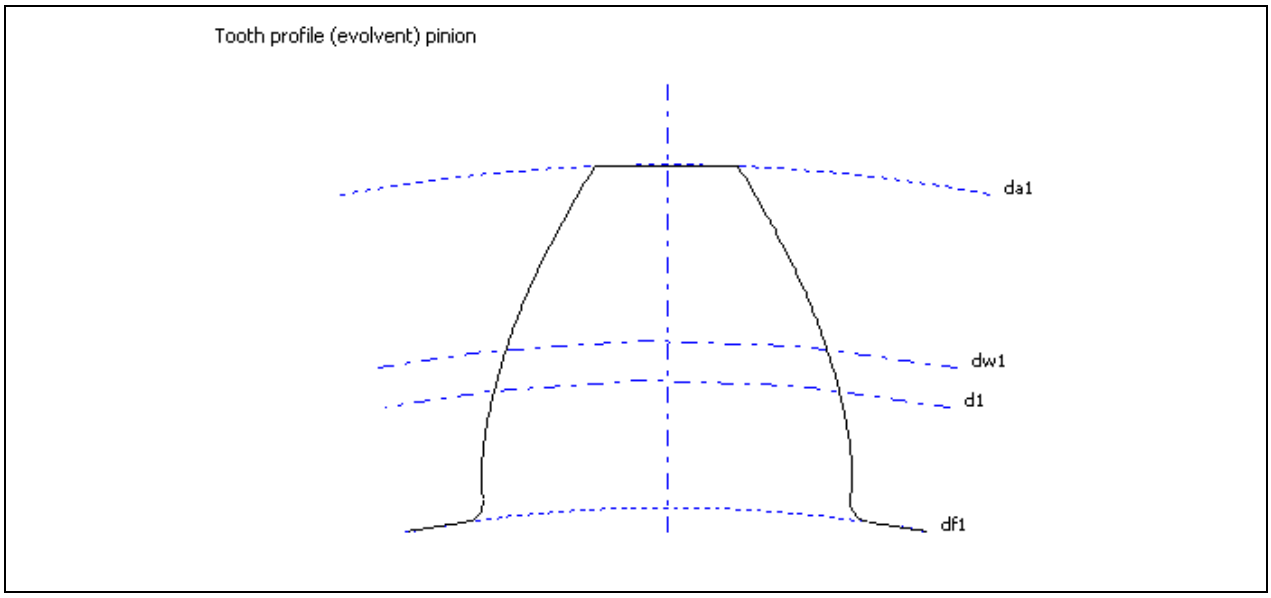


Figure 36: Tooth profile pinion

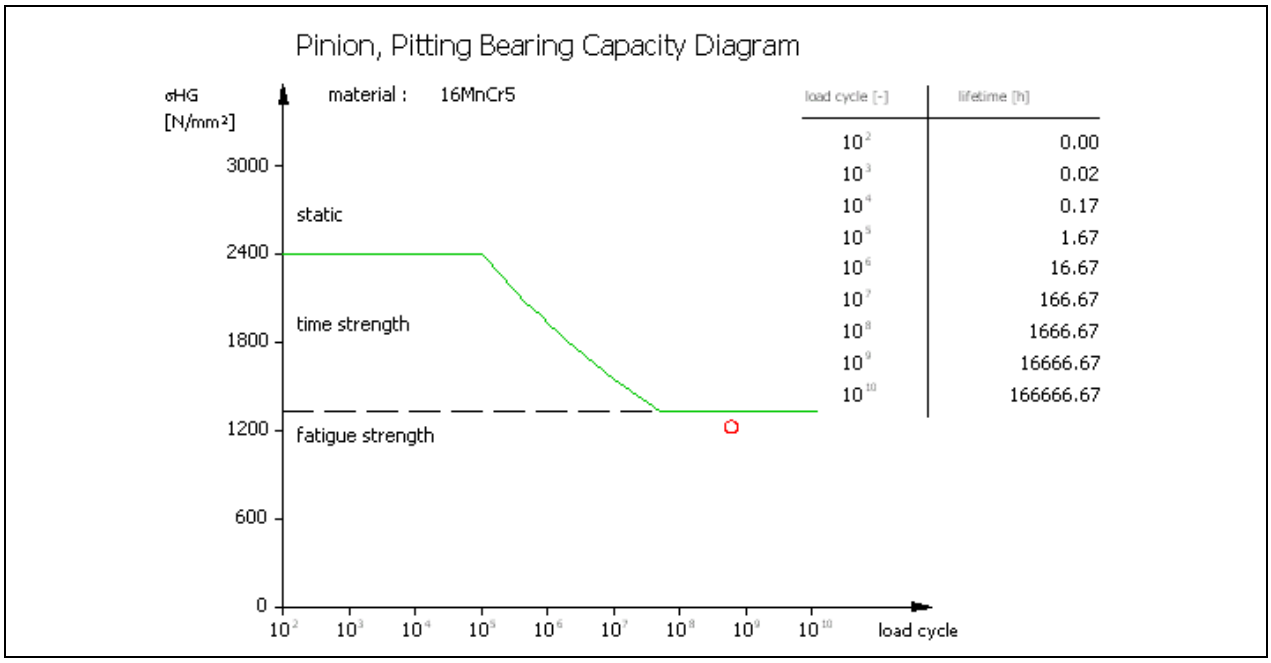
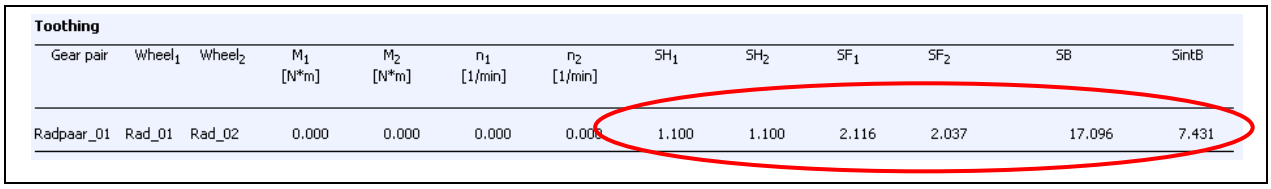


Figure 37: Pinion, pitting bearing capacity diagram



Toothing

Gear pair	$Wheel_1$	$Wheel_2$	M_1 [N*m]	M_2 [N*m]	n_1 [1/min]	n_2 [1/min]	SH_1	SH_2	SF_1	SF_2	SB	SintB
Radpaar_01	Rad_01	Rad_02	0.000	0.000	0.000	0.000	1.100	1.100	2.116	2.037	17.096	7.431

Figure 38: Results of the gear pair calculation

Exit the gear pair calculation by pressing the cross.

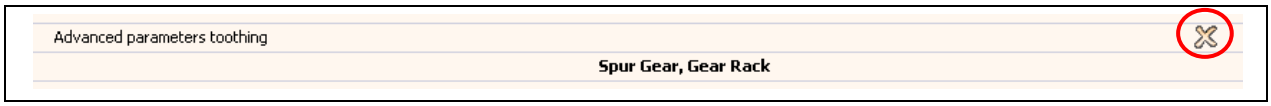


Figure 39: Exit the calculation

4.3 Calculation of the shafts

To calculate and specify a shaft, select the entry shaft in the topic “Choice of elements for the calculation”. At first we will use “Welle_01”. Most of the geometrical data are already set threw the graphical input. For a realistic calculation there are some more information necessary like notches. They can be chosen in an appropriate table.
In the column “Type” is a button for graphical help. It will show you the required dimensions for the different notch shapes.
On top of the table you will find a button which allows you to choose the notch by a graphical selection. Please click on the entry “Feather key joint, 1 groove”.

Use the following parameters:

Notch

Nr.	Type =	x mm	d: mm	t: mm	r mm	2r mm	m mm	L mm
1	Feather key joint, 1 gr...	20	80	0	0	0	0	60

Figure 40: Specifications of the feather key joint

To check if all parameters are set correctly, you can use the graphic help button on top of the table. In the right graphic display should be a 3D-model of the shaft with all torques, forces, bearings and notches. Now you can start the calculation by pressing F10.

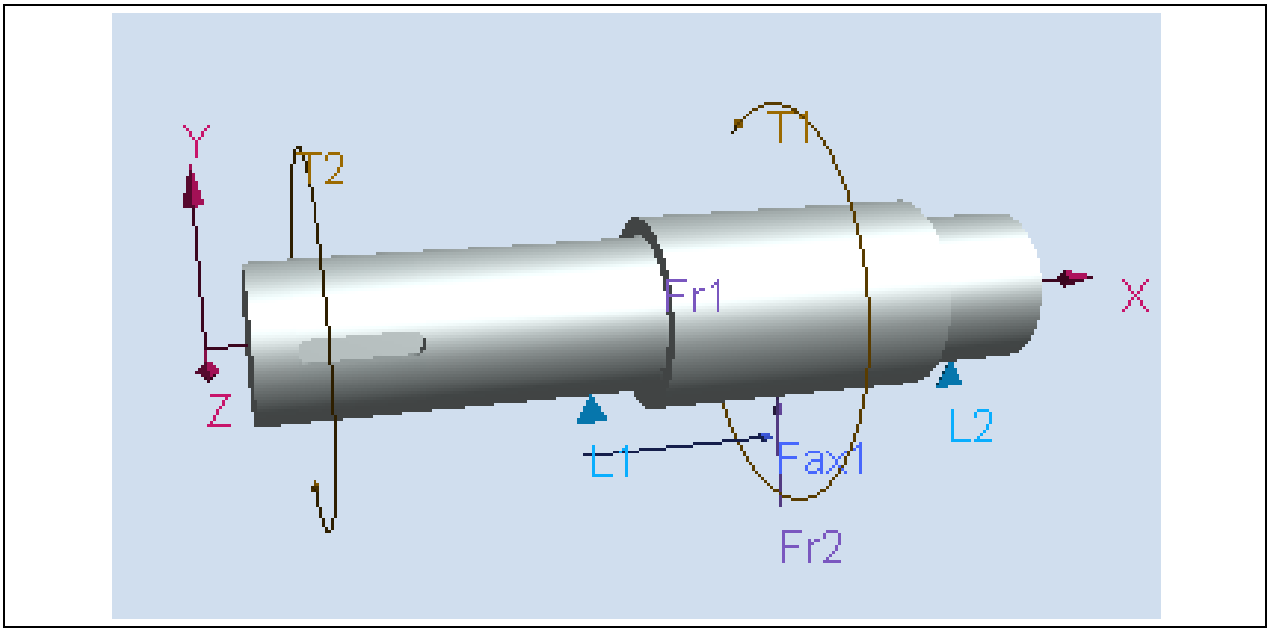


Figure 41: 3D calculation model of “Welle_01”

The output page now shows the resulting securities and intermediate results of the calculation. They can be documented if designated.

Results of recalulation

Shaft calculation

Shaft	S_F	S_d	n [1/min]
Welle_01	3.959	3.565	1000.000

Bearing

Bearing	F_x [N]	F_y [N]	F_z [N]	F_r [N]	F_a [N]	Designation	Lifetime [h]	S_0	d_i [mm]	d_a [mm]	B [mm]
Lager_01	0.000	-9837.800	-36138.500	-	-	-	-	-	-	-	-
Lager_02	-19990.300	-23811.700	-36138.500	-	-	-	-	-	-	-	-

Figure 42: Results of the calculation for “Welle_01”

In addition the graphical output will show you diagrams with torque, force and bending trend curves. Two examples are pictured bellow.

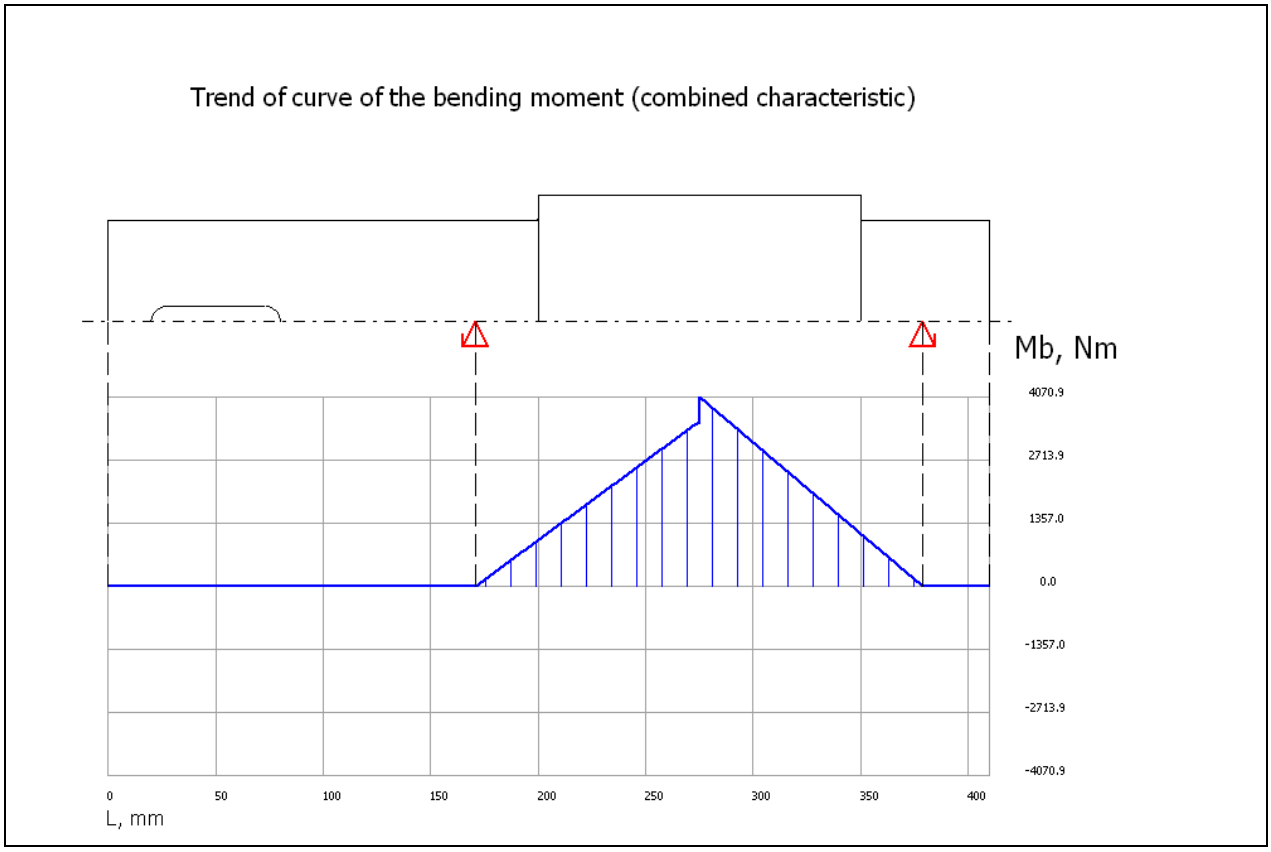


Figure 43: Trend of curve of the bending moment

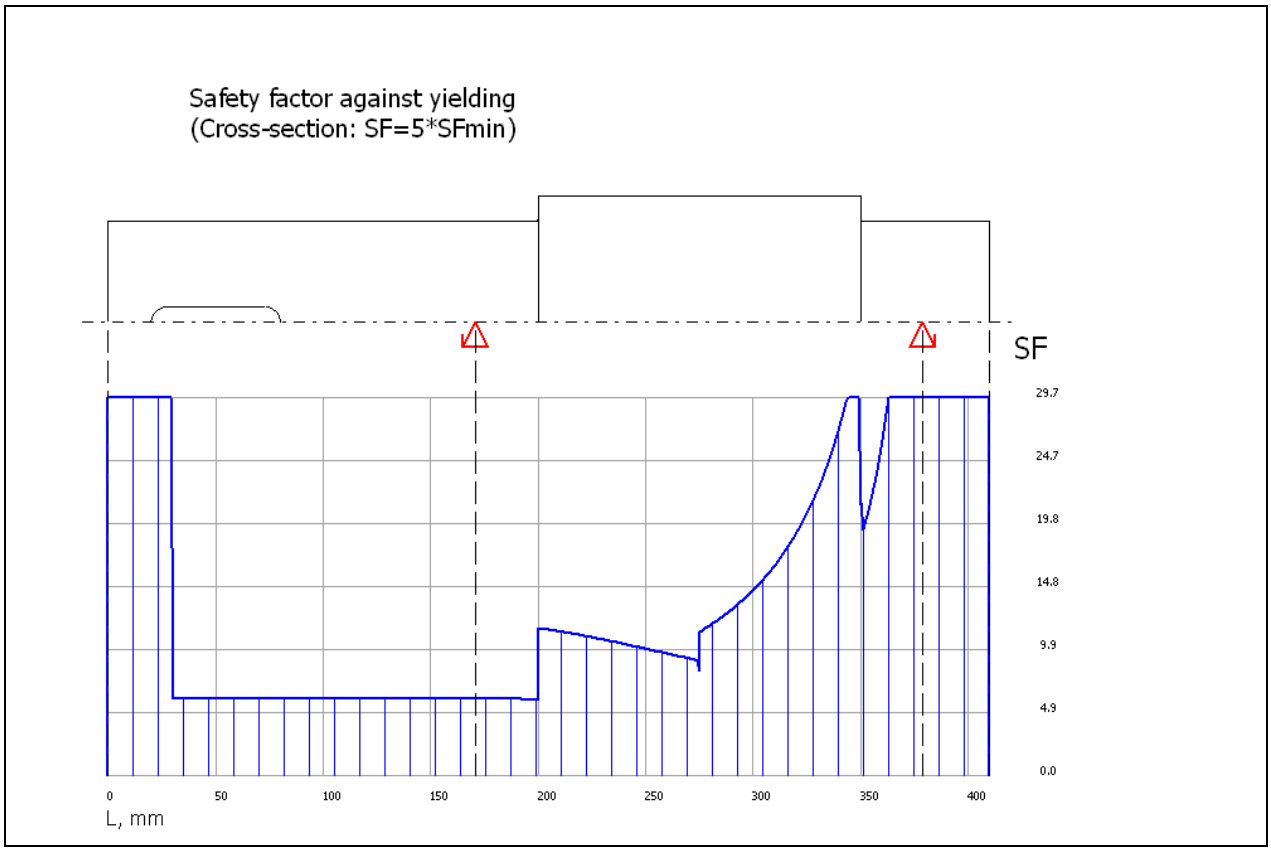


Figure 44: Safety factor against yielding

Now make the calculation for “Welle_02”. Enter two notches in the table like bellow.

Notch

Nr.	Type =	x mm	d: mm	t: mm	r mm	2r mm	m mm	L mm
1	Press-fit connection	50	130	0	0	0	0	108
2	Spline shaft	390	112	0	0	0	0	80

Figure 45: Specifications of the two notches

The resulting 3D-model should look like in the following picture.

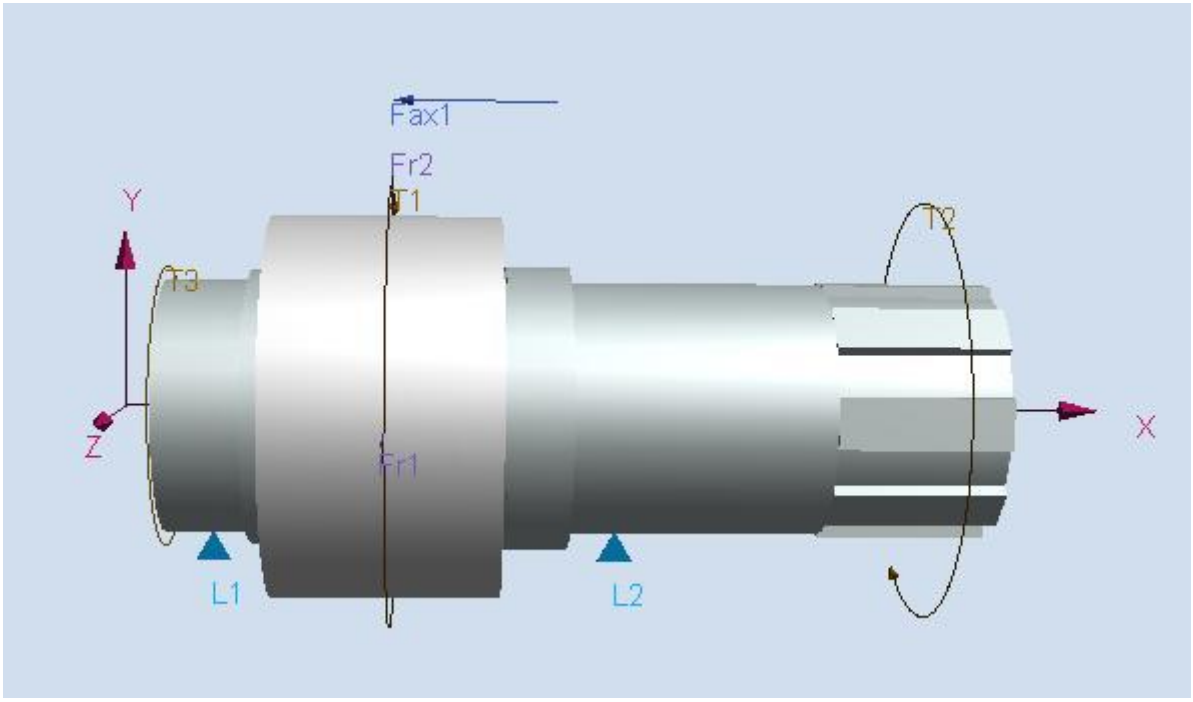


Figure 46: 3D-model for the second shaft

Leave the detailing mode by clicking on the cross in the topic “Advanced parameters shaft”.

4.4 Calculating the bearings

This time select the entry “Choice bearing” and start with “Lager_01”.
Now you can specify your requirements of the bearings. Gearbox will suggest you suitable bearings from the internal database. For this example, you can use the standard settings. In the topic “Bearing parameters” you can choose a bearing type by using the graphical interface. Please click on the entry “Tapered roller bearing”.

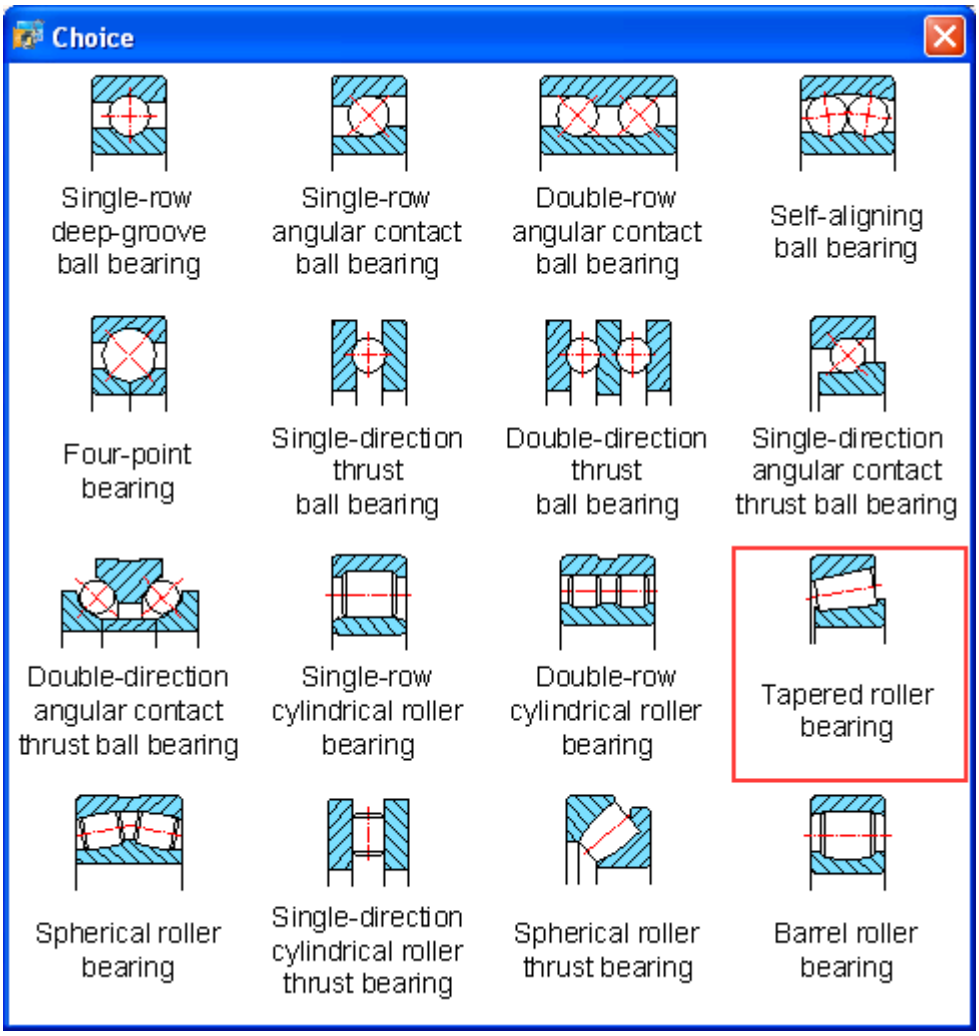


Figure 47: Graphical interface for choosing a bearing type from the bearing catalog

If you have destined a special bearing for your gear, you can specify your bearing parameters. In this example it is not necessary. Start the calculation by pressing F10 on your keyboard.
A table with tapered roller bearings, which will conform to the required lifetime, will appear. Select the bearing 32316A.

Choice : Tapered roller bearing

Number of decimal digits 2 Update

d, mm	Da, mm	B, mm	Co, kN	C, kN	ng, 1/min	m, kg	Number	Series	Form	Manufacturer
80.00	140.00	46.00	380.00	250.00	4800.00	3.23	33216	332	normal	FAG
80.00	170.00	39.00	345.00	290.00	4500.00	4.34	30316A	303	normal	FAG
80.00	170.00	58.00	540.00	400.00	4500.00	6.57	32316A	323	normal	FAG
80.00	170.00	58.00	510.00	360.00	4300.00	7.02	32316B	323	normal	FAG
85.00	150.00	49.00	440.00	290.00	4500.00	3.50	33217	332	normal	FAG
85.00	180.00	41.00	375.00	310.00	4300.00	4.83	30317A	303	normal	FAG
85.00	180.00	41.00	305.00	255.00	4300.00	4.88	31317	313	normal	FAG
85.00	180.00	60.00	585.00	430.00	4300.00	7.50	32317A	323	normal	FAG
85.00	180.00	60.00	600.00	415.00	4300.00	7.86	32317	323	normal	FAG
90.00	150.00	45.00	425.00	265.00	4500.00	3.19	33118	331	normal	FAG
90.00	160.00	40.00	360.00	260.00	4500.00	3.78	32218A	322	normal	FAG
90.00	190.00	43.00	325.00	275.00	4000.00	5.50	31318	313	normal	FAG
90.00	190.00	43.00	400.00	335.00	4000.00	5.83	30318A	303	normal	FAG
90.00	190.00	64.00	655.00	490.00	4000.00	8.51	32318A	323	normal	FAG
95.00	170.00	43.00	415.00	300.00	4300.00	4.24	32219A	322	normal	FAG
95.00	200.00	45.00	440.00	365.00	3600.00	6.77	30319A	303	normal	FAG
95.00	200.00	45.00	365.00	305.00	3600.00	6.50	31319A	313	normal	FAG
95.00	200.00	67.00	710.00	530.00	3600.00	10.30	32319A	323	normal	FAG
100.00	180.00	34.00	325.00	250.00	4300.00	3.75	30220A	302	normal	FAG
100.00	180.00	46.00	475.00	335.00	4000.00	5.67	32220A	322	normal	FAG
100.00	215.00	47.00	510.00	415.00	4300.00	8.38	30320A	303	normal	FAG
100.00	215.00	51.00	480.00	380.00	3000.00	8.81	31320X	313	normal	FAG
100.00	215.00	73.00	850.00	610.00	3400.00	12.90	32320A	323	normal	FAG
105.00	160.00	43.00	450.00	265.00	4300.00	3.34	33021	330	normal	FAG
105.00	190.00	36.00	365.00	280.00	4000.00	4.23	30221A	302	normal	FAG
105.00	190.00	50.00	550.00	380.00	3600.00	6.07	32221A	322	normal	FAG
105.00	225.00	77.00	930.00	670.00	3000.00	15.10	32321A	323	normal	FAG
110.00	170.00	38.00	400.00	240.00	4000.00	3.07	32022X	320	normal	FAG
110.00	170.00	47.00	520.00	300.00	4300.00	4.16	33022	330	normal	FAG
110.00	200.00	38.00	415.00	315.00	3600.00	5.23	30222A	302	normal	FAG
110.00	200.00	53.00	600.00	415.00	3400.00	7.35	32222A	322	normal	FAG

OK Cancel Find

Figure 48: Chose the bearing type from the database

On the output page you will find the expected lifetime of the bearing as well as the static security. In addition there will be the data of the selected bearing.

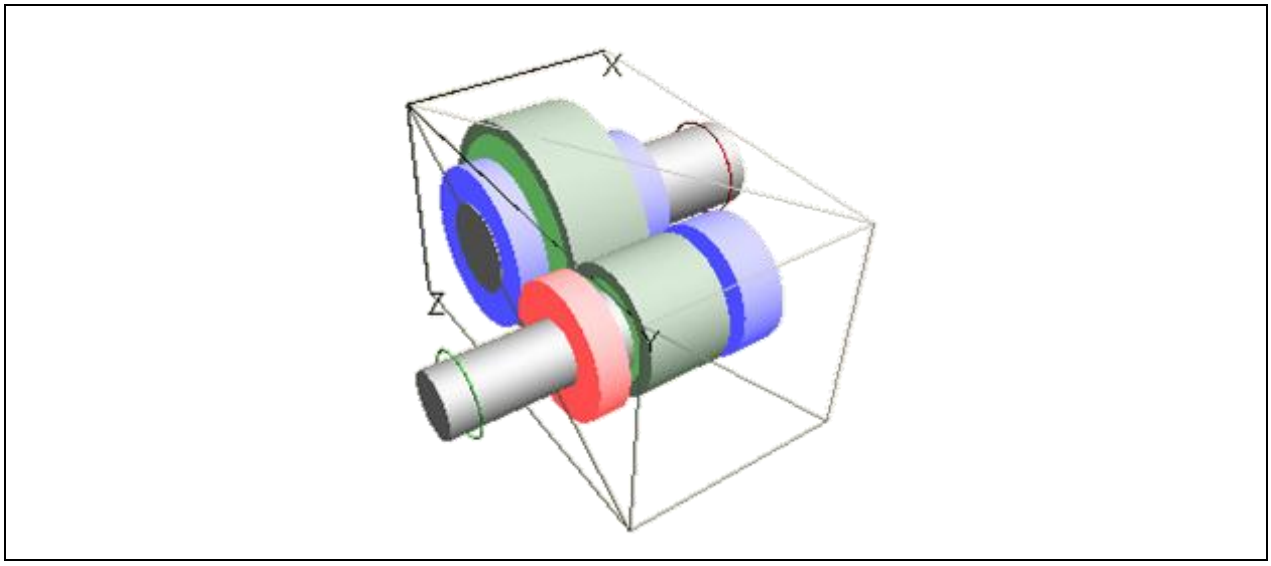


Figure 49: 3D-model of the first bearing

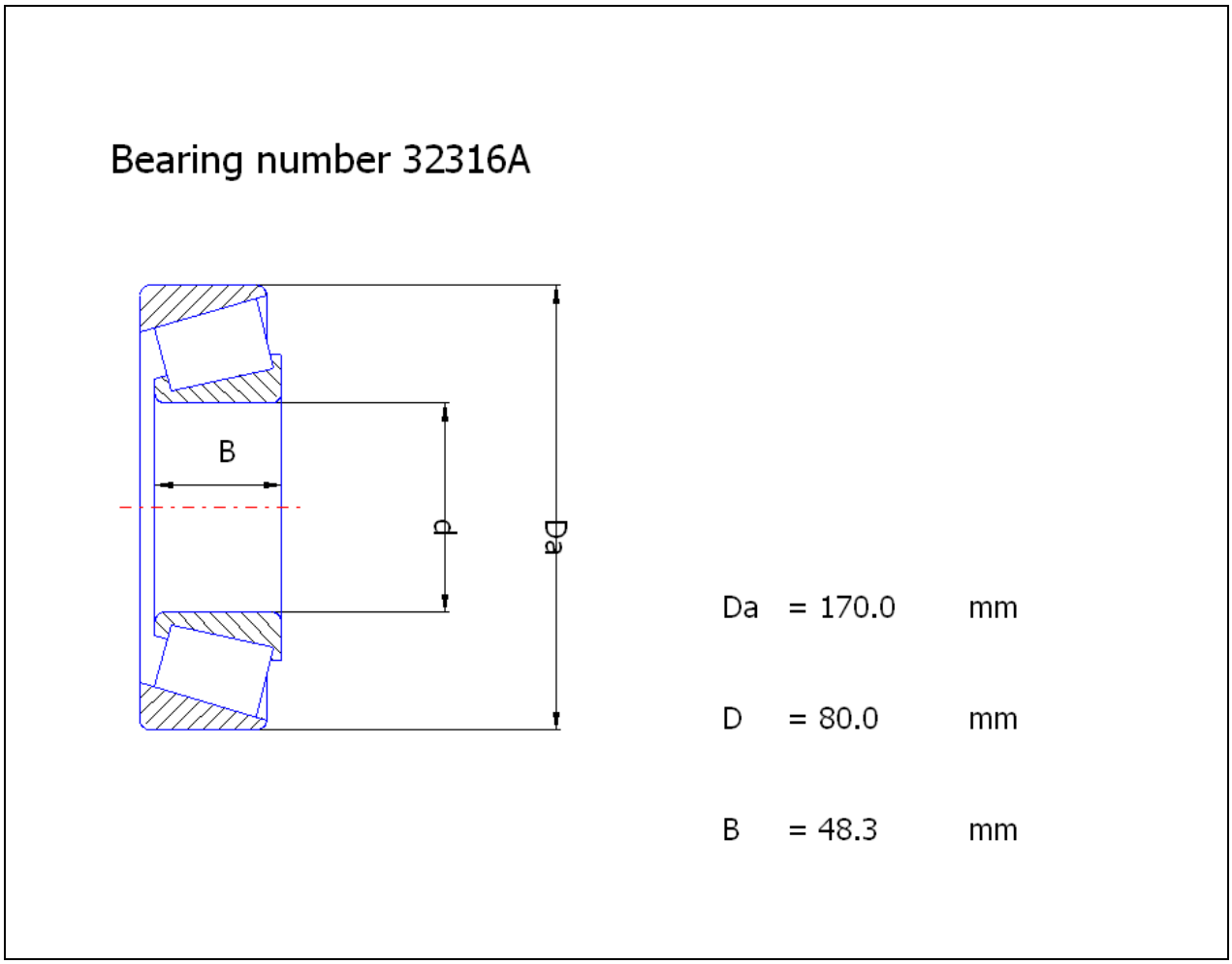


Figure 50: Figure of the chosen bearing

Repeat these steps for the other bearings. Choose bearing types like this:

Lager_02: Tapered roller bearing – 32316A
Lager_03: Tapered roller bearing – 30224A
Lager_04: Tapered roller bearing – 33024

Now you have constructed the gear completely and specified sufficiently. Please consider, that this example will give you just a rough gear design to give you an understanding of the single steps in the software

4.5 Calculation of all elements

Now that all mechanic parts are specified, you can make a calculation for all parts. Choose in the topic “Choice of elements for the calculation” → “All elements”.

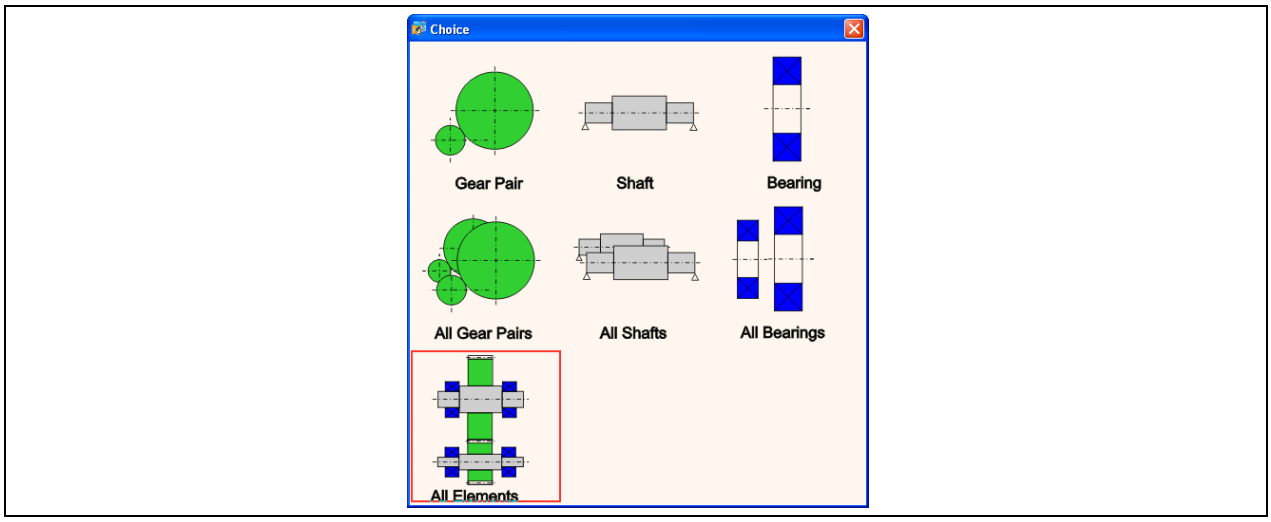


Figure 51: Calculation all elements

As a result you will get an overview of all calculation results.

Results of recalulation

Kinematics

Drive	Driven gear	Speed [1/min]	Torque [N*m]	Power [kW]
Antrieb_01	-	1000.000	4774.650	500.000
-	Abtrieb_01	-500.000	9453.807	-495.000

Transmission ratio

relation	kinematic ratio	static ratio
Antrieb_01/Abtrieb_01	-2.000	0.505

Toothing

Gear pair	$Wheel_1$	$Wheel_2$	M_1 [N*m]	M_2 [N*m]	n_1 [1/min]	n_2 [1/min]	SH_1	SH_2	SF_1	SF_2	SB	SintB
Radpaar_01	Rad_01	Rad_02	-4774.650	-9549.300	1000.000	-500.000	1.100	1.100	2.116	2.037	17.096	7.430

Shaft calculation

Shaft	S_F	S_d	n [1/min]
Welle_01	3.959	3.565	1000.000
Welle_02	3.330	4.347	-500.000

Bearing

Bearing	F_x [N]	F_y [N]	F_z [N]	F_r [N]	F_a [N]	Designation	Lifetime [h]	S_0	d_i [mm]	d_a [mm]	B [mm]
Lager_01	0.000	-9837.800	-36138.500	37453.618	0.000	Tapered roller bearing FAG 32316A	44709.800	14.400	80.000	170.000	58.000
Lager_02	-19990.300	-23811.700	-36138.500	43278.034	19990.300	Tapered roller bearing FAG 32316A	14884.900	12.500	80.000	170.000	58.000
Lager_03	19990.300	33704.820	40236.510	52488.014	19990.300	Tapered roller bearing FAG 30224A	16889.200	8.700	120.000	215.000	40.000
Lager_04	0.000	-55.328	32040.180	32040.228	0.000	Tapered roller bearing FAG 33024	64332.800	17.500	120.000	180.000	48.000

Figure 52: Calculating all elements

5. Save the project data

All calculation data for the calculation are stored in a project folder.
By default the folder is temporarily on your PC. If you create a new calculation file, all data in the temporary folder will be erased. That's why it is important to choose a new target directory. If you do this after the calculation, you can copy all data to the new directory.
Choose a directory like figured below and confirm the warning with "yes". Afterwards you should safe the project again. By the next use of the software all data will be restored.

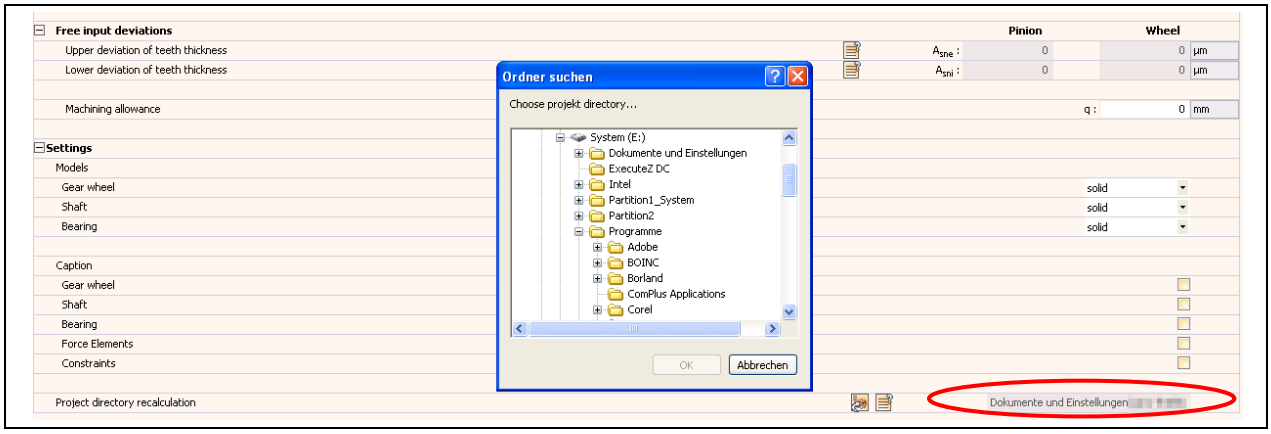


Figure 53: Definition of the poject folder

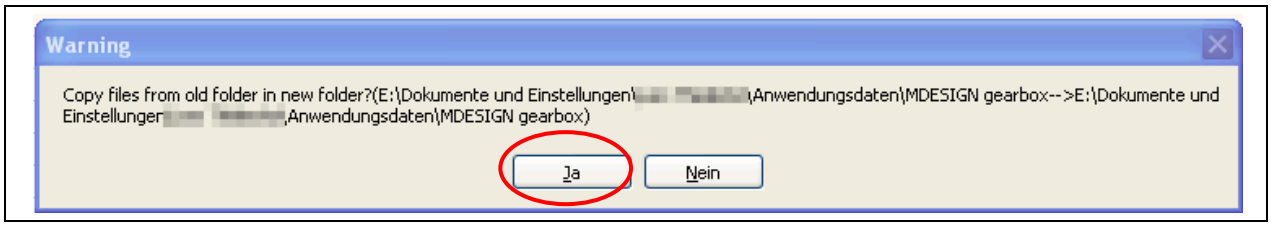


Figure 54: Copy the date from the temporary folder to the new project directory

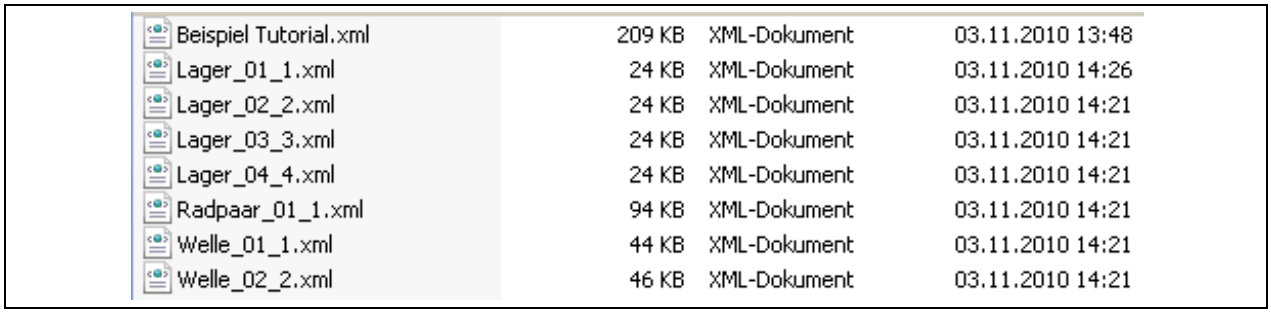


Figure 55: Calculation data in the project folder

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