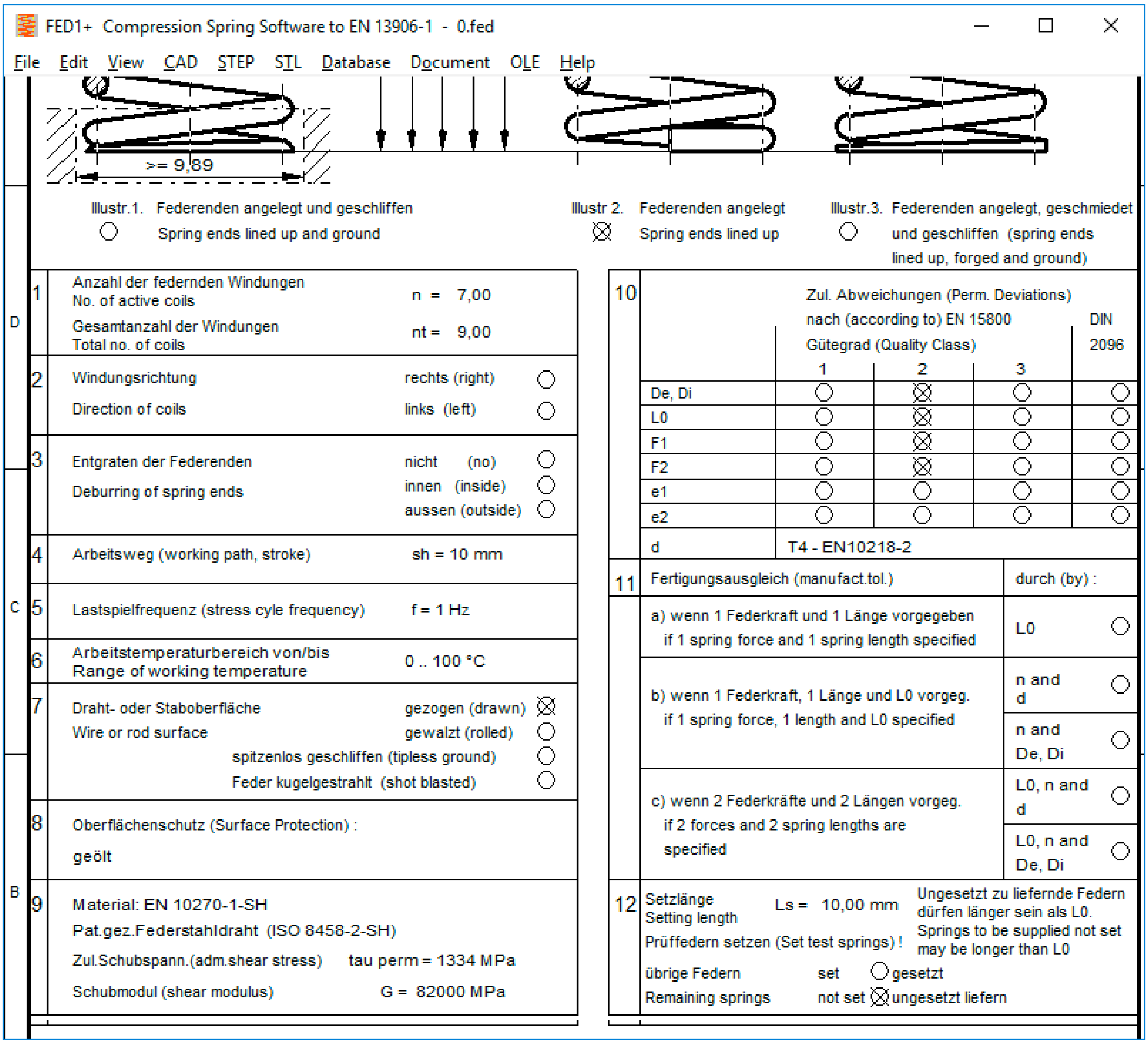
by Fritz Ruoss

FED1+, 5, 6, 7, 17: Production Drawing German/English

Production drawing in dual language German/English can be generated for compression springs now (View, Print, CAD DXF/IGES).



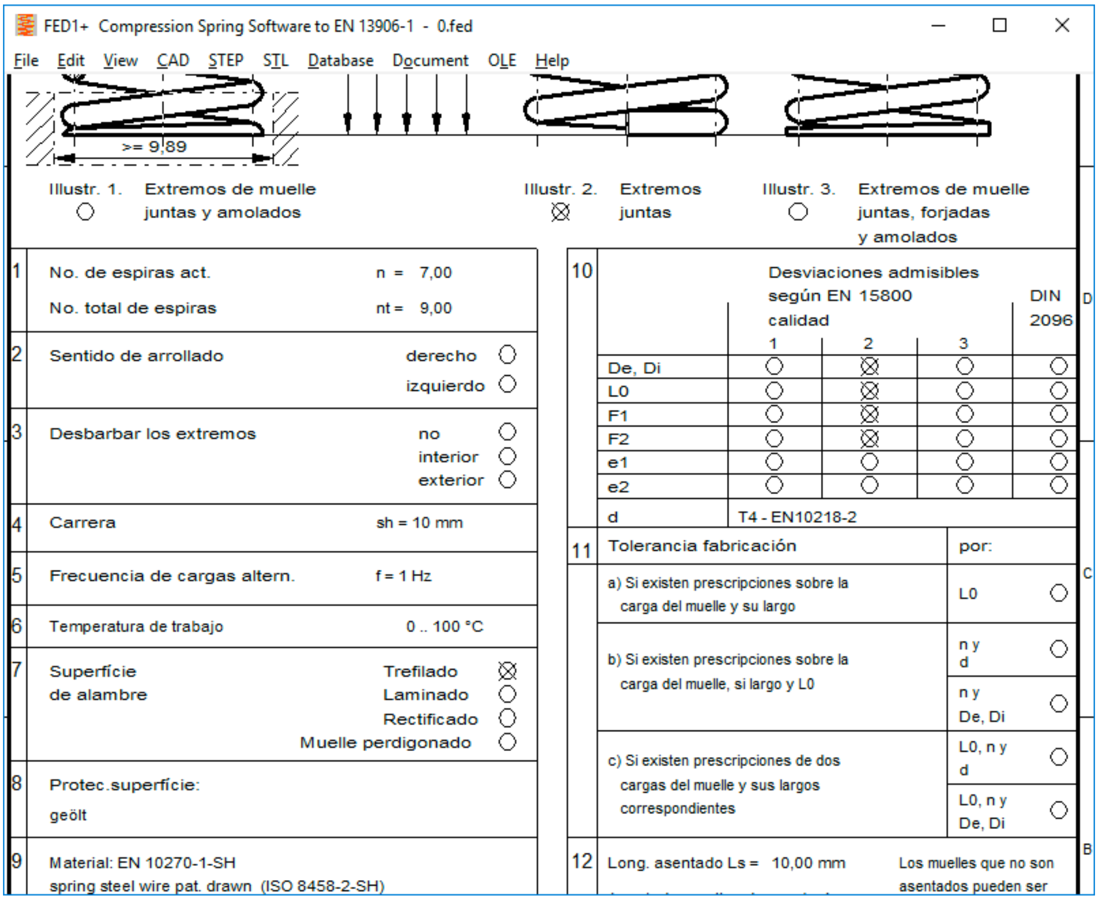
FED3+: 3D Centerline as STEP file

Centerline of torsion spring can be generated as STEP file to the loaded into CAD.

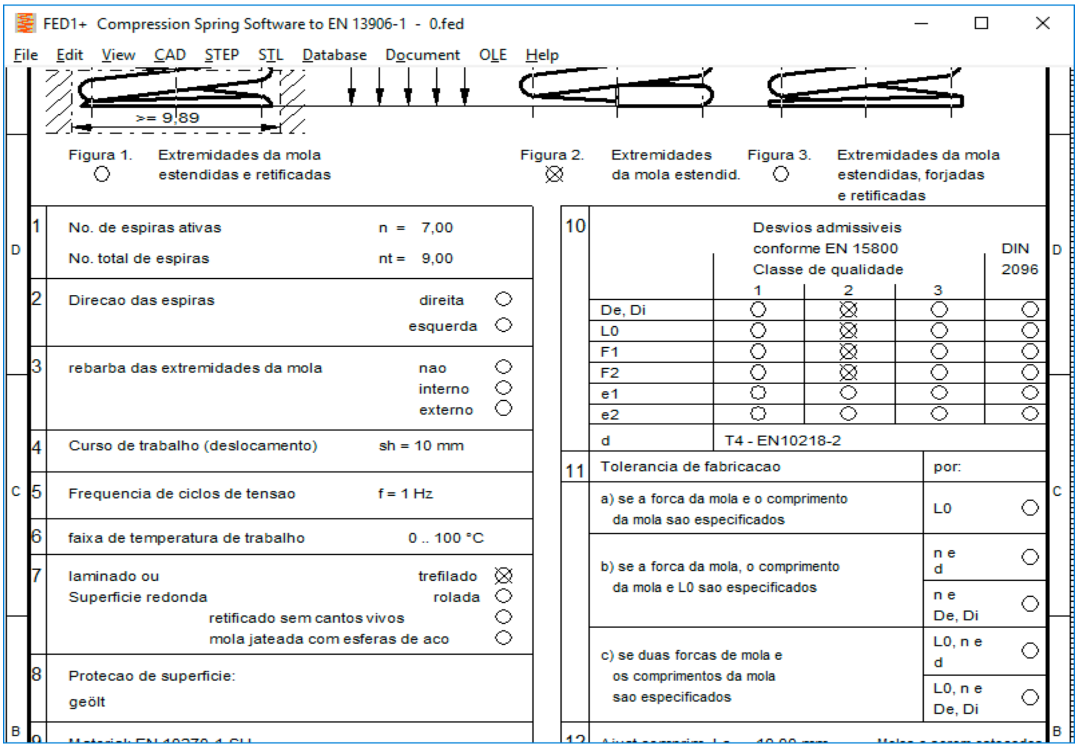
FED9,10,13,14,15,16: Incoloy A-286

Incoloy A-286 (spring temper and spring temper + aged) has been added in the material database fed9wst.dbf.

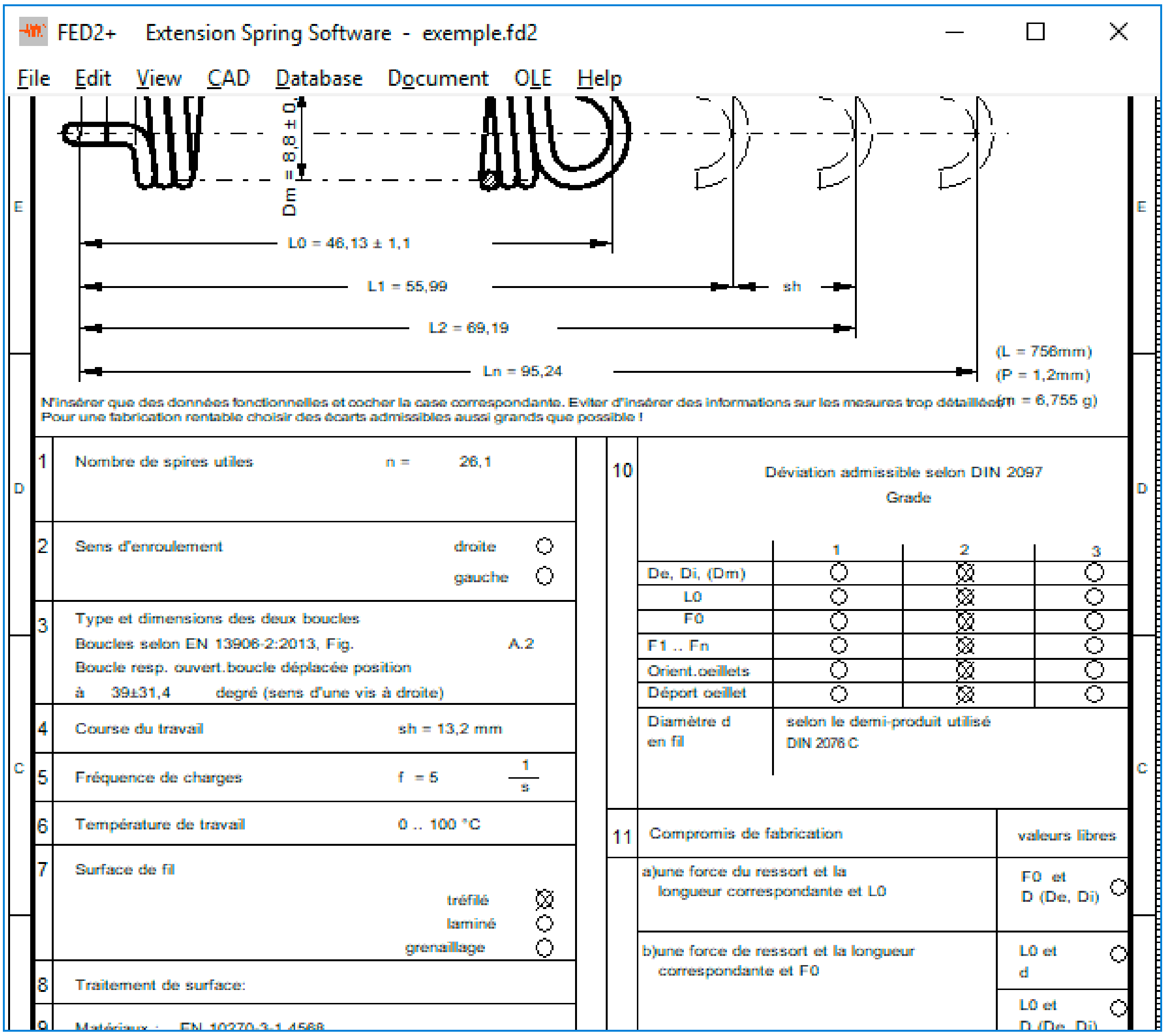
FED1+, 5, 6, 7, 17: Production Drawing International DE,EN,FR,IT,SV,PT,ES,NL
Production drawing of compression spring can now be generated in German, English, French, Italian, Swedish, Spanish, Portugues and Dutch language.



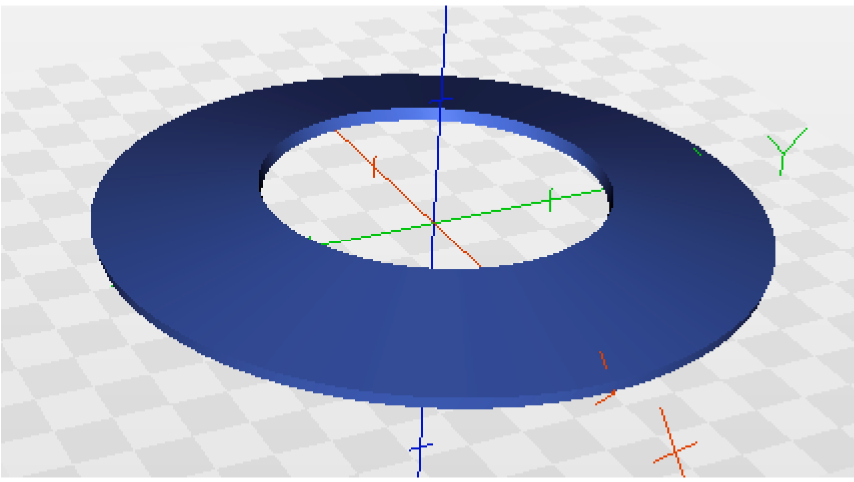
At "View -> Production drawing International" you can choose the desired drawing language.



FED2+: Production drawing International DE,EN,FR,IT,SV,ES,NL
Production drawing of extension springs can now be generated in German, English, French, Italian, Swedish, Spanish and Dutch language.



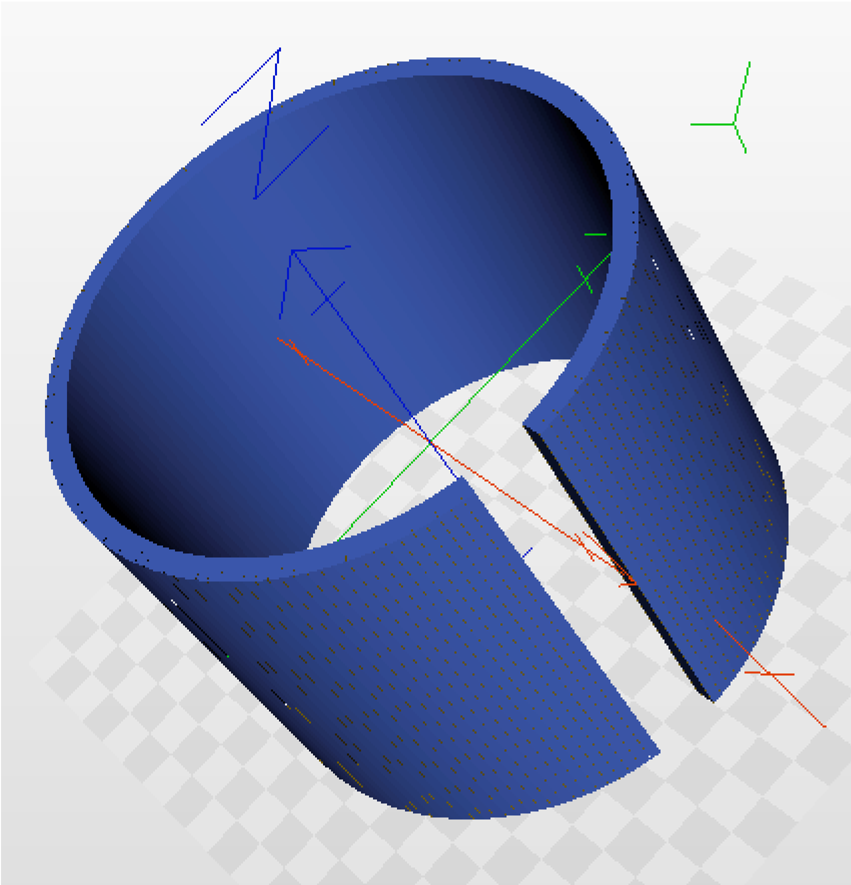
FED4: STL Disk Spring
Disk spring can be generated as 3D STL model now.



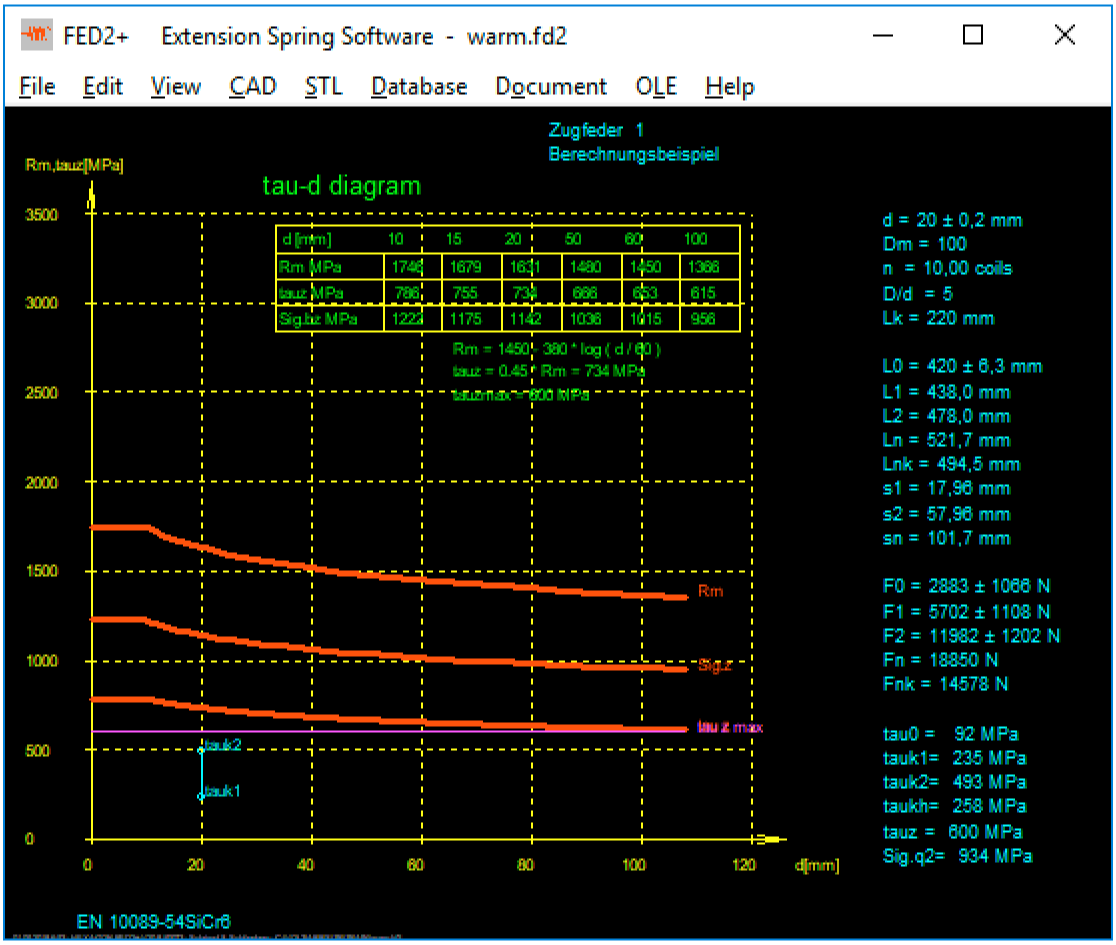
FED1+,2+,3+,5,6,7,8,11,17: "OTEVA 91 not nitrided" modified
Strength properties for Goodman diagram of OTEVA 91 (VD-SiCrVMo) were too low in not nitrided state, because data strength values were based on d=1 instead to d=3.85mm. Data in fedwst.dbf have been corrected. Thanks to Mr. Gaedtke of HAWE Hydraulik for his hint.

FED1+,2+,3+,5,6,7,8,11,17: OTEVA 74 SC, OTEVA 76 SC, OTEVA 96 SC
3 new OTEVA valve spring wires have been added to the fedwst.dbf spring wire database:
OTEVA 74 SC is an oil tempered SiCr-alloyed valve spring wire, shaved. Tensile strength and fatigue resistance is eaqual with OTEVA 75 SC (VD-SiCrV), but until 200°C only.
OTEVA 76 SC is an oil tempered SiCrVNi-alloyed valve spring wire, shaved. Tensile strength and fatigue resistance is the same as OTEVA 75 SC (VD-SiCrV)
OTEVA 96 SC is an oil tempered SiCrVMo-alloyed valve spring wire, shaved. Tensile strength and fatigue resistance is the same as OTEVA 90 SC (VD-SiCrVMo)
The strength properties of OTEVA 90, 91, 96 are the same.
We have no relaxation charts for the OTEVA materials. In the data sheets there are such, but for preset springs only. Relaxation chart in data sheet shows that there is no further relaxation if working temperature is below 100 °C.

FED11: STL Model
FED11 generates a 3D model of the calculated spring lock or bushing as STL file now.

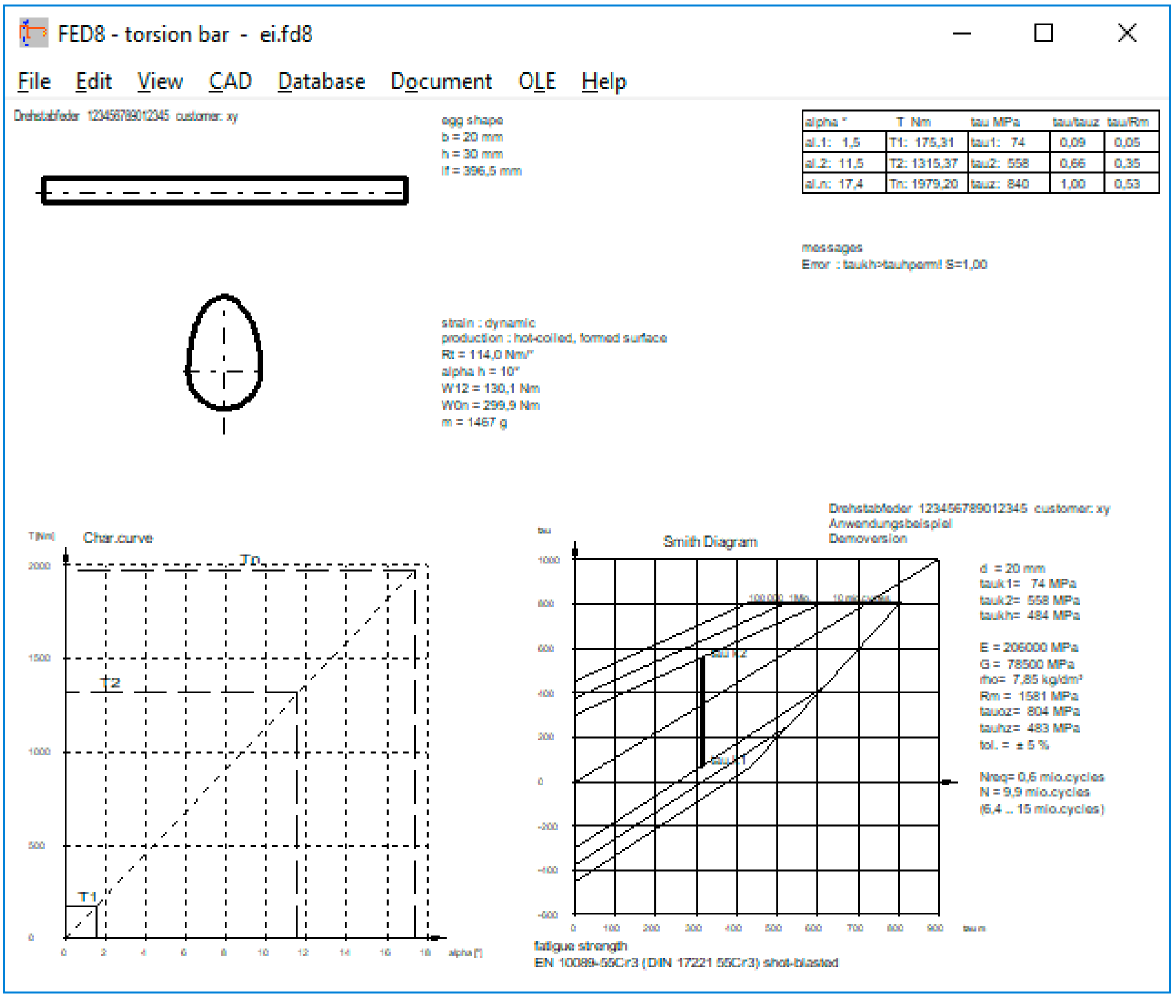


FED1+,2+,3+,5,6,7,8,11,17: Hot-rolled spring material to EN 10089
In EN standards there are 2 sources for the permissible shear stress of hot-formed compression springs: in EN 13906-1 (10.1.2) there is a diagram for tauzul depending on the wire or rod diameter, but irrespective of the material. EN 10089 includes min/max tensile strength of various materials, but irrespective of the diameter. The program calculates tauz = 840-250 * log (d/20), derived from the diagram in EN 13906, and tauz = 0.56 * rm to EN 10089. The smaller of the two values is used for calculation. Since this is usually the value of the EN 13906, the values from the database remain virtually ignored. Nevertheless, the material database FEDWST.DBF has now been modified that the tensile strength Rm depends on the diameter of the wire or rod. In adaptation to the diagram from EN 13906, Rmmin applies to d = 60mm and Rmmax for D < = 10mm. In the tau-d diagram, the curve for tauzmax is now additionally drawn in accordance with EN 13906 (if hot formed springs only). In the previous version, it was not possible to see where the value tauz comes from. For 38Si7 and 51CrV4, the curves are almost identical, whereas for materials of higher strength (e.g. 60SiCr7) the tauz curve from the database is significantly higher than the tauzmax curve according to EN 13906. In a later version, maybe we could add an option to ignore the permissible shear stress according to EN 13906 and use the higher value from the database instead, if there are reliable facts. I would be happy to accept suggestions and measured values from you.



For tension springs, tauzmax = 600 MPa is indicated for hot formed springs according to EN 13906, irrespective of wire or rod diameter. Else, tauz = 0.45 Rm should be used for tension springs according to EN 13906. FED2+ uses the smaller value of 600 MPa and 0.45 Rm. In most cases, 0.45 Rm is larger than 600 MPA, so the permissible shear stress for most hot-formed tension springs is Tauz = 600 MPa.

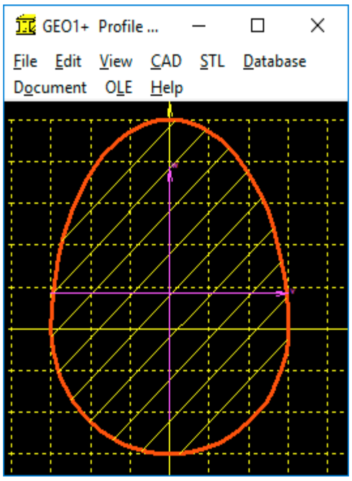
FED8: Torsion bar in egg shape

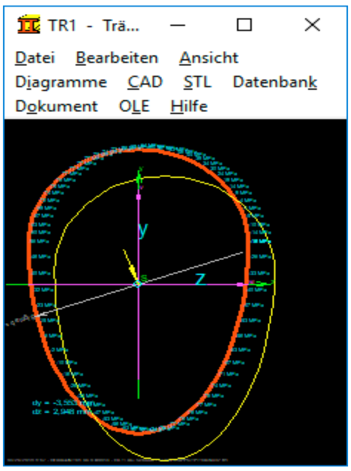


An egg-shaped cross-section is composed of a semicircle and a half ellipse. Thus also the mass moment of inertia and the polar area moment of inertia is calculated, as the sum of half circle and half ellipse. However, this is just an approximation.

GEO1+, TR1: Ellipse and Egg-shape

Generating of ellipse and egg-shape has been added in GEO1+ and TR1. GEO1+ calculates area moment of inertia, center of gravity and mass moment of inertia. TR1 additionally calculates bending curve and bending stress of the special shaped girder.



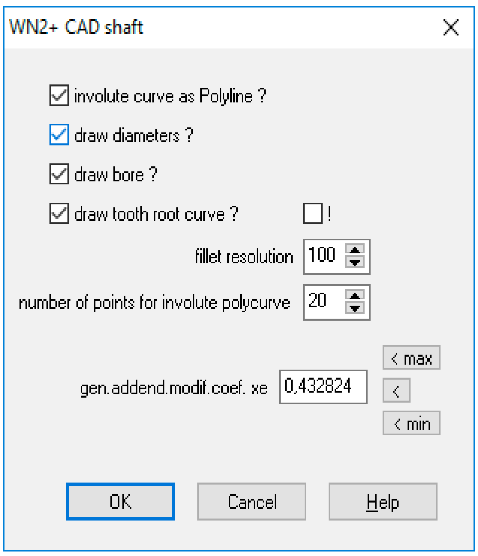


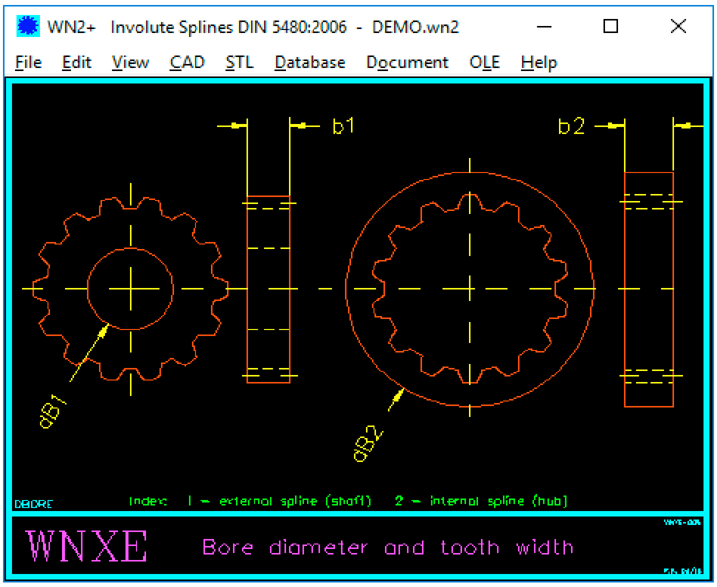
TR1: Quick3 and Quick4 View

Quick3 View and Quick4 View has been added to girder software TR1 with drawings of cross-section, bedding and loads, tables with input data and calculation results, altogether on one screen.

WN2+: Configure drawing with/without bore

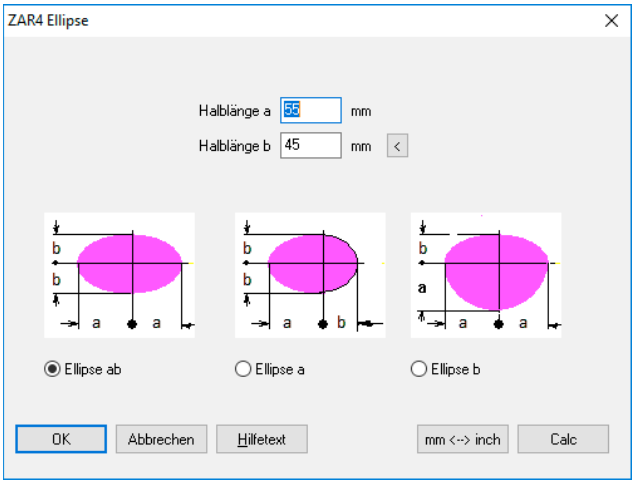
If the tooth profile is used for conversion into a CNC program or for wire eroding, the drawing must be displayed without a bore hole. On the other hand, if you want to create an STL model on the 3D printer, you need the drawing with bore hole. For internal gearing, the bore hole diameter dB means the outer diameter of the hub (negative sign). There is also a new help picture, this one now belongs to WN2, 4, 5, 6, 7, 8, 9, 10, WNXE, WNXP, ZAR1 +,4, 5, 7, 8, ZARXP, ZAR1W.





ZAR4, GEO4: Half ellipse (Egg shape)

At ellipse gear input, you now also can generate an egg-shape gear composed by a half ellipse over 180° and a semicircle. Three types can be generated: Full ellipse, half ellipse with small radius semicircle, and half ellipse with large radius semicircle.



ZAR4 – center distance shift for flank clearance

Unlike round gears, the backlash is not adjusted by a flank tolerance, but by the center distance in the case of noncircular gears. Therefore you can now enter a center distance. This must be slightly larger (backlash/tan alpha) than the calculated center distance. In gear drawing and gear animation, the modified center distance is used now instead of the calculated zero-backlash center distance.

ZAR4 – DXF Import

The pitch curve of a noncircular gear wheel can be imported as a polyline in DXF format. If the polyline contains arcs, they are now taken in 1 ° increments.

ZAR4 – Printout List

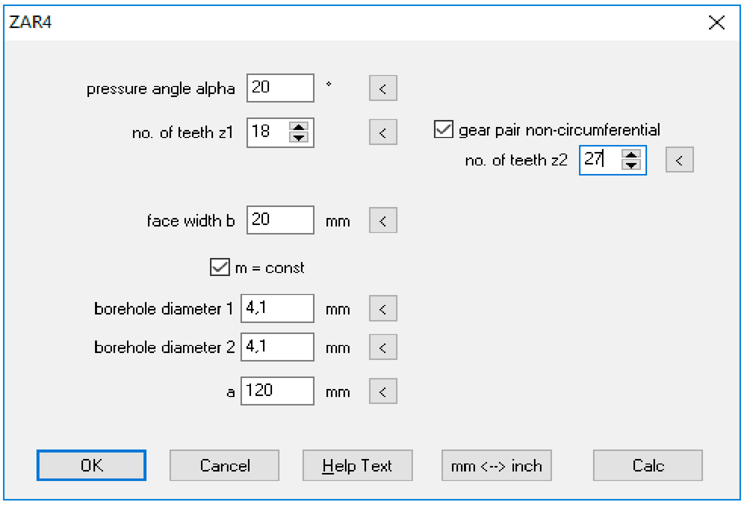
Angle of rotation of gear wheels 1 and 2, radii, transmission ratio, speed and acceleration can now be displayed in 1 ° increments.

ZAR4   c:\temp\outwin.txt

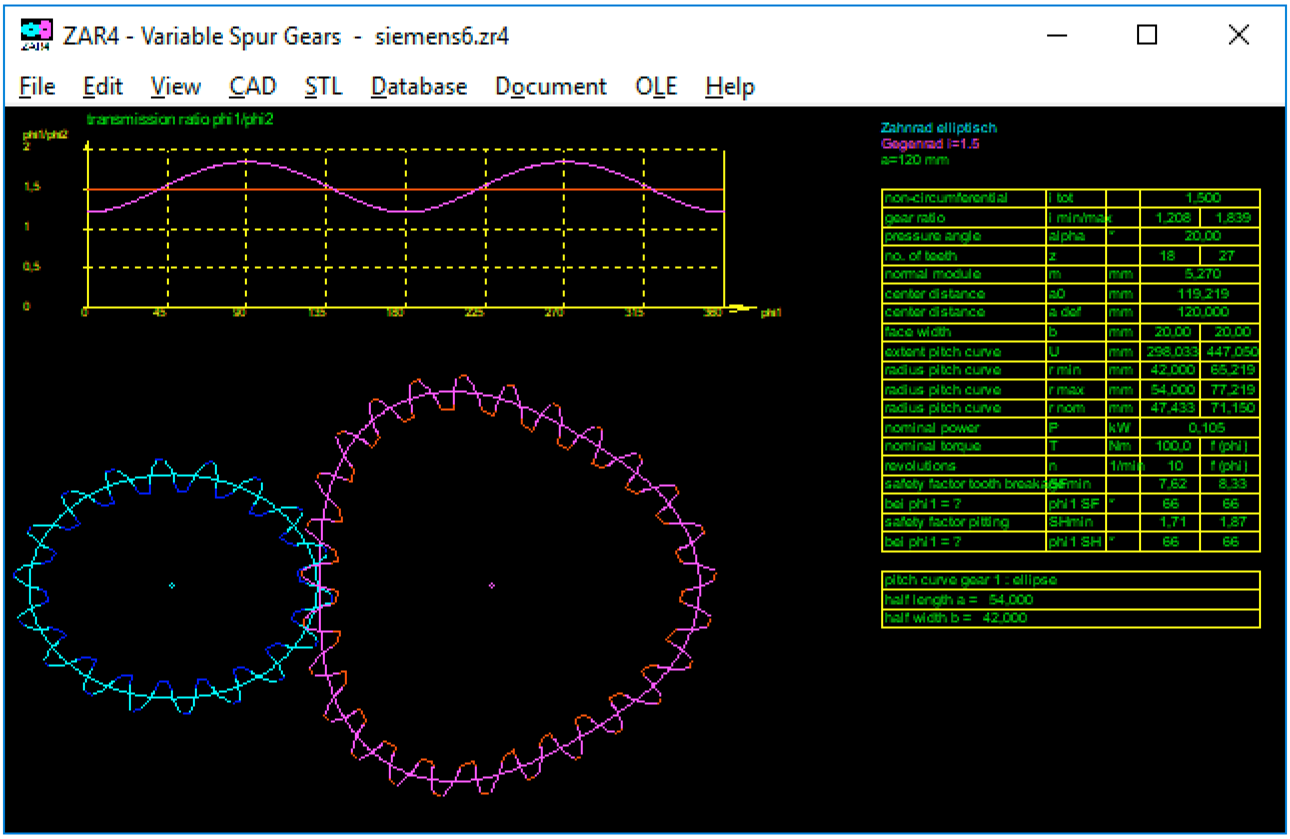
Datei   Bearbeiten

phi1 °	phi2 °	r1 mm	r2 mm	i=r2/r1	v2 1/s	a2 1/s2
1,0	-0,9	55,00	63,87	1,161	0,00	0,00
2,0	-1,7	54,98	63,88	1,162	0,90	0,00
3,0	-2,6	54,96	63,90	1,163	0,90	-0,04
4,0	-3,4	54,93	63,93	1,164	0,90	-0,05
5,0	-4,3	54,90	63,97	1,165	0,90	-0,07
6,0	-5,2	54,85	64,01	1,167	0,90	-0,08
7,0	-6,0	54,80	64,06	1,169	0,90	-0,10
8,0	-6,9	54,74	64,13	1,171	0,89	-0,11
9,0	-7,7	54,67	64,19	1,174	0,89	-0,12
10,0	-8,6	54,60	64,27	1,177	0,89	-0,14
11,0	-9,4	54,51	64,35	1,181	0,89	-0,15
12,0	-10,3	54,42	64,44	1,184	0,88	-0,16
13,0	-11,1	54,33	64,54	1,188	0,88	-0,17
14,0	-11,9	54,22	64,64	1,192	0,88	-0,19
15,0	-12,8	54,11	64,75	1,197	0,88	-0,20
16,0	-13,6	54,00	64,87	1,201	0,87	-0,21
17,0	-14,4	53,87	64,99	1,206	0,87	-0,22
18,0	-15,3	53,75	65,12	1,212	0,86	-0,22
19,0	-16,1	53,61	65,25	1,217	0,86	-0,23
20,0	-16,9	53,48	65,39	1,223	0,86	-0,24
21,0	-17,7	53,33	65,53	1,229	0,85	-0,25
22,0	-18,5	53,19	65,68	1,235	0,85	-0,25
23,0	-19,3	53,04	65,83	1,241	0,84	-0,26

ZAR4: Free transmission ratio for non-circumferential gears

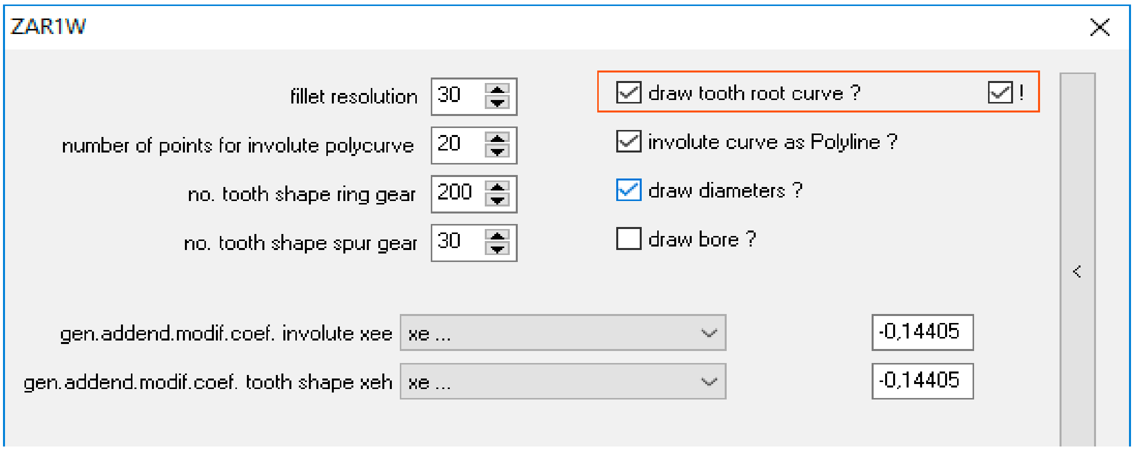


For circulating nonlinear gears, the total transmission ratio must be 1 or 2 or larger integer. If only a sector of the nonlinear gear is used, e.g. for a control lever, then this restriction can be reduced, the total transmission ratio can then have any value. This case can now also be calculated in ZAR4, for this case choose "gear pair non-circumferential" and enter number of teeth of the counterwheel. Tooth profile is not closed at phi = 360 ° and matching teeth no longer run together. But there are also exceptions: if the pitch curve of gear 1 is symmetrical, the gear pair is also running if the total transmission ratio is 1.5 or 2.5.

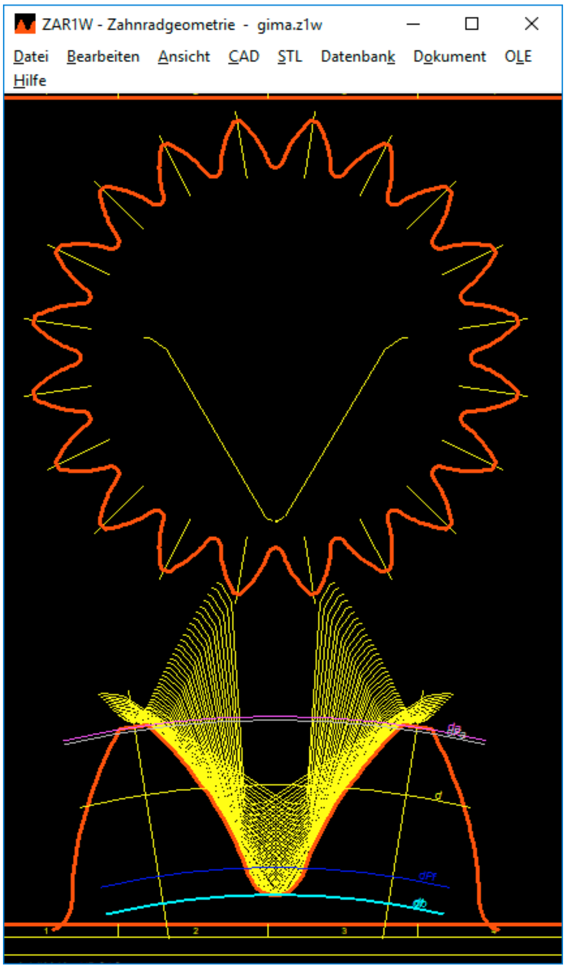


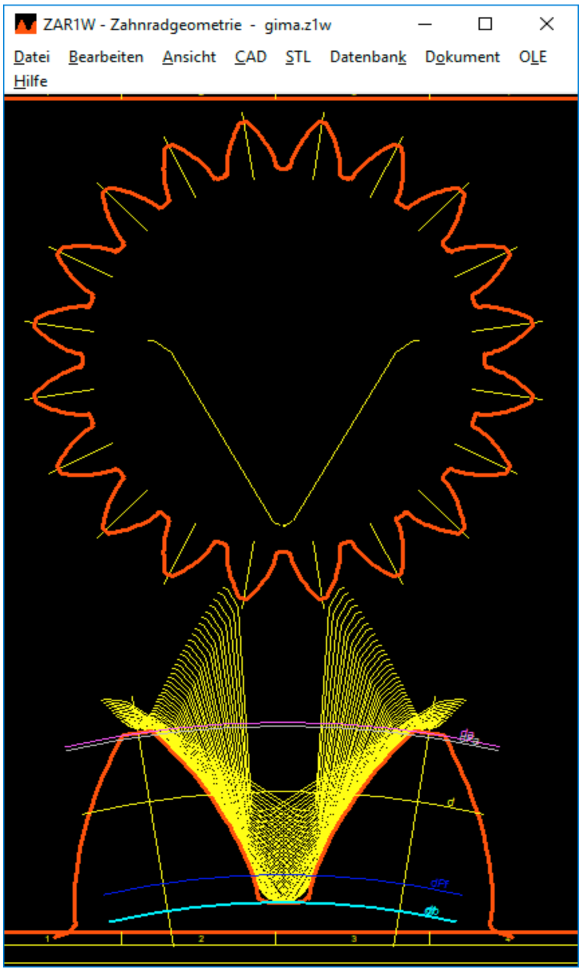
See calculation for elliptic driving wheel with generated counter wheel for total transmission ratio of 1.5.

ZAR1+, ZAR1W: Draw tooth root fillet trochoide settings

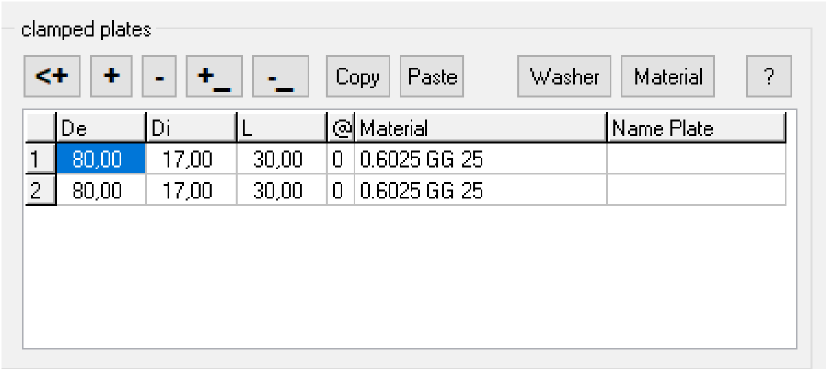


If the option "Draw tooth root curve" is set under "CAD-> Settings", then the trochoide curve generated by cutting tool will be drawn in case of undercut. Without undercut, fillet of the cutting tool is drawn. In rare cases (for "lace" gearing tools with a low frontal tooth width) there is a gap between the cutting tool shape (yellow) and the tooth fillet curve (red) in this drawing. For this case there is now a second checkbox (!) on the right, then a trochoide curve is always drawn. However, this option is not suitable as a permanent setting because, for example, involute splines according to DIN 5480 are drawn with a spike. Sometimes (but not always) helps in this case to increase the fillet resolution setting.



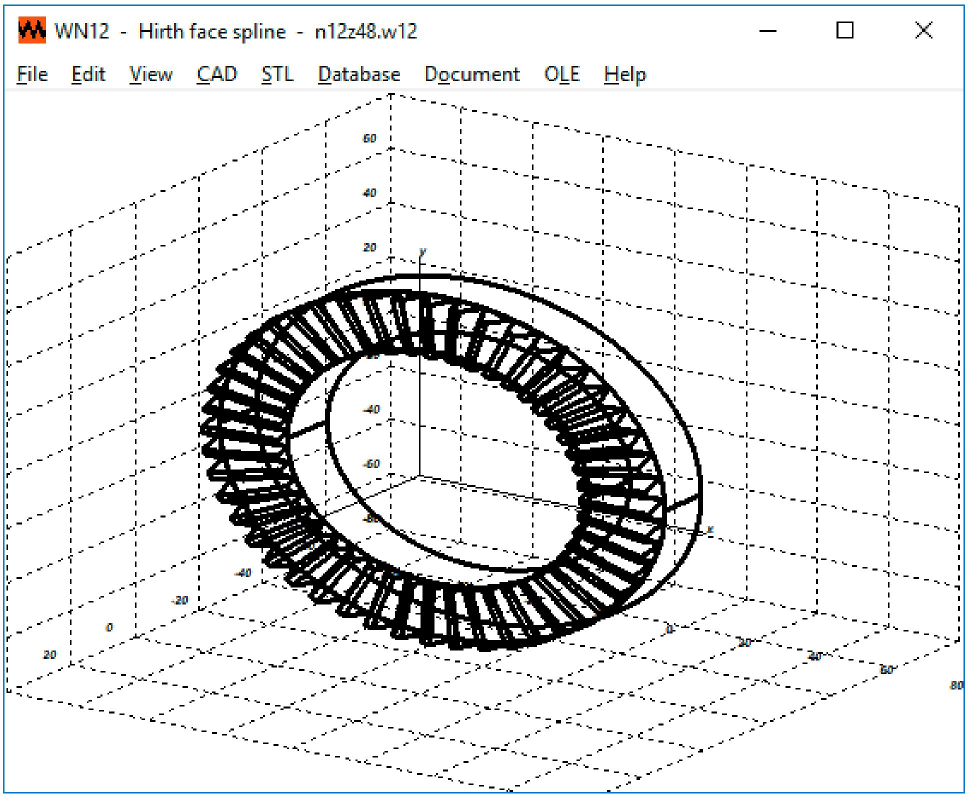


FED1+,6,7,10,WL1+,GEO1+,2,4,SR1+,TOL1,TR1,WN1,ZAR4: Improved Input Tables
For tables for entering shaft sections at WL1 +, spring sections at FED6 and FED7, clamping plates at SR1 +, dimensions for GEO1 +, GEO2, GEO4, ZAR4, TR1, WN1, there are improvements to insert and delete rows, and export/import with Excel.



Buttons at input tables:
+: add new row
<+: add new row and copy data from previous row
- : delete last row
+_ : insert new row at cursor position
-_ : delete row at cursor position
Copy: copy marked cells into clipboard
Paste: fill cells with clipboard content at cursor position
New buttons are "+_" and "-_". Tables for large amount of data like dimensions in WL1+, TR1, GEO1+, GEO4, ZAR4, or load spectrum of gear programs additionally got a menu with import/export functions for data exchange with MS-Excel.

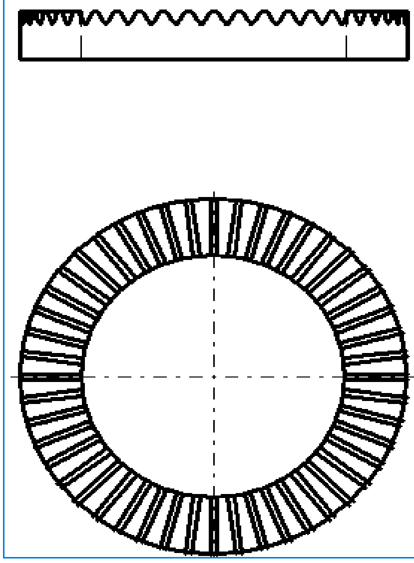
WN12 – New Software for Face Splines



The new WN12 software calculates the dimensions of face splines. Outside diameter, inner diameter, teeth, fillet radius and tooth tip clearance and tooth gap angle are input data. WN12 calculates the surface area, surface pressure and safety factor from torque, preload and material data. The tooth drawing is generated by the program and can be exported to CAD. A model of a ring with face spline can be made with 3D printers, WN12 generates an STL file for it. Standard sizes can be selected from the integrated database. Alternatively, the dimensions for self-defined face splines can be entered directly.

WN12 - Hirth face spline - n12z48.w12

File Edit View CAD STL Database Document OLE Help



N12-D125			
No. of teeth	z		48
Gap angle	gamma	°	60.00
major diameter	De	mm	125.00
minor diameter	Di	mm	85.00
height	hg	mm	16.70
Height until teeth center	hzm	mm	15.00
tooth height exterior	he	mm	4.32
tooth height interior	hi	mm	2.05
tooth height angle	alpha	°	3.23
tooth fillet	r	mm	0.92
tooth tip width	bk	mm	2.13
tip clearance	S	mm	0.92
pressure height exterior	hpe	mm	3.40
torque	Tmax	Nm	1700
Tangential force	Fu	N	32381
axial load	Fa	N	18695
axial preload	Fva	N	14021
area	Az	mm²	2512
pressure	pmax	MPa	20
material: S235JR (St 37-2) 1.0037			
yield strength	Re	MPa	235
load bearing coeff.	klamb.		0.65
Perm.surface pressure	plim	MPa	282
safety plim/pmax	Sp		14.1

Error : Fva < Fa
Warning: Fva/Fa < 1.8

Because there is no ISO or DIN standard for face splines, you can display and print out the names and formulas used in WN12.

WN12 - Hirth face spline - decker.w12

File Edit View CAD STL Database Document OLE Help

No. of teeth	z		12
Gap angle	gamma	°	60.00
major diameter	De	mm	30.00
minor diameter	Di	mm	22.00
Height until teeth center	hzm	mm	5.80

torque	Tmax	Nm	80
axial preload	Fva	N	6150
material: S275JRC (St 44-2) 1.0044			
yield strength	Re	MPa	275
load bearing coeff.	klamb.		0.75

Symbol	Formula	Result	Unit
beta	beta=gamma/2	30	°
He	He=pi/2/tan(beta)*De/z	6.802	mm
Hi	Hi=pi/2/tan(beta)*Di/z	4.988	mm
Hm	Hm=(He+Hi)/2	5.895	mm
alpha	alpha=arctan(pi/tan(beta)/z)/2	12.20	°
lr	lr=r/sin(beta)	1.2	mm
lrs	lrs=r*(1/sin(beta)-1)+S	1.2	mm
hpe	hpe=He-2*lrs	4.402	mm
hpi	hpi=Hi-2*lrs	2.588	mm
he	he=He-lrs-lr+r	5.002	mm
hi	hi=Hi-lrs-lr+r	5.002	mm
la	la=Hm-2*lrs)/cos(beta)	4.036	mm
bk	bk=tan(beta)*2*lrs	1.386	mm
hz	hz=2*hzm	11.60	mm
hg	hg=hzm-lrs+ha/2	11.60	mm
Fu	Fu=4*Tmax/(De+Di)	6154	N
Fa	Fa=Fu*tan(beta)	3553	N
Az	Az=la*(De-Di)/2*z	193.7	mm²
pmax	pmax=(Fva+Fa)/Az/klambda	66.79	MPa
plim	plim=Re*fh*fs	330	MPa
Sp	Sp=plim/pmax	4.941	

A production drawing with ISO 7200 data field contains profile drawings and tables with dimensions. The drawings can be printed or exported to CAD.

HEXAGON PRICELIST 2018-05-01

PRODUCT	EUR
DI1 Version 1.2 O-Ring Seal Software	190.-
DXF-Manager Version 9.1	383.-
DXFPLOT V 3.2	123.-
FED1+ V30.3 Helical Compression Springs incl. spring database, animation, relax., 3D,..	695.-
FED2+ V20.8 Helical Extension Springs incl. spring database, animation, relaxation, ...	675.-
FED3+ V19.3 Helical Torsion Springs incl. prod.drawing, animation, 3D, rectang.wire, ...	480.-
FED4 Version 7.5 Disk Springs	430.-
FED5 Version 16.0 Conical Compression Springs	741.-
FED6 Version 16.6 Nonlinear Cylindrical Compression Springs	634.-
FED7 Version 13.6 Nonlinear Compression Springs	660.-
FED8 Version 7.1 Torsion Bar	317.-
FED9 Version 6.0 Spiral Spring	394.-
FED10 Version 4.2 Leaf Spring	500.-
FED11 Version 3.5 Spring Lock and Bushing	210.-
FED12 Version 2.5 Elastomer Compression Spring	220.-
FED13 Version 4.0 Wave Spring Washers	228.-
FED14 Version 2.0 Helical Wave Spring	395.-
FED15 Version 1.4 Leaf Spring (simple)	180.-
FED16 Version 1.1 Constant Force Spring	225.-
FED17 Version 1.5 Magazine Spring	725.-
GEO1+ V7.3 Cross Section Calculation incl. profile database	294.-
GEO2 V3.1 Rotation Bodies	194.-
GEO3 V3.3 Hertzian Pressure	205.-
GEO4 V4.3 Cam Software	265.-
GEO5 V1.0 Geneva Drive Mechanism Software	218.-
GEO6 V1.0 Pinch Roll Overrunning Clutch Software	232.-
GR1 V2.1 Gear construction kit software	185.-
HPGL-Manager Version 9.1	383.-
LG1 V6.6 Roll-Contact Bearings	296.-
LG2 V2.2 Hydrodynamic Plain Journal Bearings	460.-
SR1 V22.9 Bolted Joint Design	640.-
SR1+ V22.9 Bolted Joint Design incl. Flange calculation	750.-
TOL1 V12.0 Tolerance Analysis	506.-
TOL2 Version 4.0 Tolerance Analysis	495.-
TOLPASS V4.1 Library for ISO tolerances	107.-
TR1 V6.0 Girder Calculation	757.-
WL1+ V21.2 Shaft Calculation incl. Roll-contact Bearings	945.-
WN1 Version 12.0 Cylindrical and Conical Press Fits	485.-
WN2 V10.1 Involute Splines to DIN 5480	250.-
WN2+ V10.1 Involute Splines to DIN 5480 and non-standard involute splines	380.-
WN3 V 5.4 Parallel Key Joints to DIN 6885, ANSI B17.1, DIN 6892	245.-
WN4 V 4.7 Involute Splines to ANSI B 92.1	276.-
WN5 V 4.7 Involute Splines to ISO 4156 and ANSI B 92.2 M	255.-
WN6 V 3.0 Polygon Profiles P3G to DIN 32711	180.-
WN7 V 3.0 Polygon Profiles P4C to DIN 32712	175.-
WN8 V 2.2 Serration to DIN 5481	195.-
WN9 V 2.2 Spline Shafts to DIN ISO 14	170.-
WN10 V 4.2 Involute Splines to DIN 5482	260.-
WN11 V 1.3 Woodruff Key Joints	240.-
WN12 V 1.0 Face Splines	256.-
WNXE V 2.1 Involute Splines - dimensions, graphic, measure	375.-
WNXK V 2.0 Serration Splines - dimensions, graphic, measure	230.-
WST1 V 10.2 Material Database	235.-
ZAR1+ V 26.3 Spur and Helical Gears	1115.-
ZAR2 V8.0 Spiral Bevel Gears to Klingelnberg	792.-
ZAR3+ V9.0 Cylindrical Worm Gears	620.-
ZAR4 V6.0 Non-circular Spur Gears	1610.-
ZAR5 V11.7 Planetary Gears	1355.-
ZAR6 V4.0 Straight/Helical/Spiral Bevel Gears	585.-

ZAR7 V1.5 Plus Planetary Gears	1380.-
ZAR8 V1.4 Ravigneaux Planetary Gears	1950.-
ZARXP V2.2 Involute Profiles - dimensions, graphic, measure	275.-
ZAR1W V2.1 Gear Wheel Dimensions, tolerances, measure	450.-
ZM1.V2.5 Chain Gear Design	326.-

PACKAGES	EUR
HEXAGON Mechanical Engineering Package (TOL1, ZAR1+, ZAR2, ZAR3+, ZAR5, ZAR6, WL1+, WN1, WN2+, WN3, WST1, SR1+, FED1+, FED2+, FED3+, FED4, ZARXP, TOLPASS, LG1, DXFPLOT, GEO1+, TOL2, GEO2, GEO3, ZM1, WN6, WN7, LG2, FED12, FED13, WN8, WN9, WN11, DI1, FED15, WNXE, GR1)	8,500.-
HEXAGON Mechanical Engineering Base Package (ZAR1+, ZAR3+, ZAR5, ZAR6, WL1+, WN1, WST1, SR1+, FED1,+, FED2+, FED3+)	4.900,-
HEXAGON Spur Gear Package (ZAR1+ and ZAR5)	1,585.-
HEXAGON Planetary Gear Package (ZAR1+, ZAR5, ZAR7, ZAR8, GR1)	3,600.-
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Language Version:
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- **French**: FED1+, FED2+, FED3+, FED4, FED5, FED6, FED7, FED9, FED10, FED13, FED14, FED15, TOL1, TOL2.
- **Italiano**: FED1+, FED2+, FED3+, FED4, FED5, FED6, FED7, FED9, FED13, FED14, FED17.
- **Swedish**: FED1+, FED2+, FED3+, FED5, FED6, FED7.
- **Portugues**: FED1+, FED17
- **Spanish**: FED1+, FED2+, FED3+, FED17

Updates:

Update prices	EUR
Software Update (software Win32/64 + pdf manual)	40.-
Software Update (software 64-bit Win + pdf manual)	50.-

Update Mechanical Engineering Package: 800 EUR, Update Complete Package: 1000 EUR
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Key Code
After installation, software has to be released by key code. Key codes will be sent after receipt of payment.

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