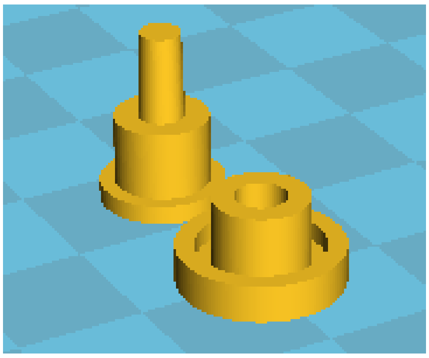
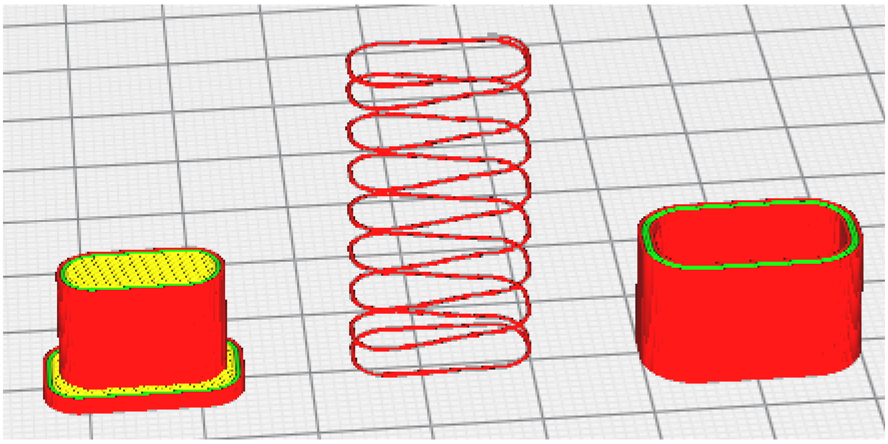
by Fritz Ruoss

FED1+, FED5: Produce spring utilities mandrel and bore with 3D printer
Shaft and hub with mandrel and bore, generated as STL file and produced with 3D printer, can be used for a test assembly of the spring and compression up to spring length L2.

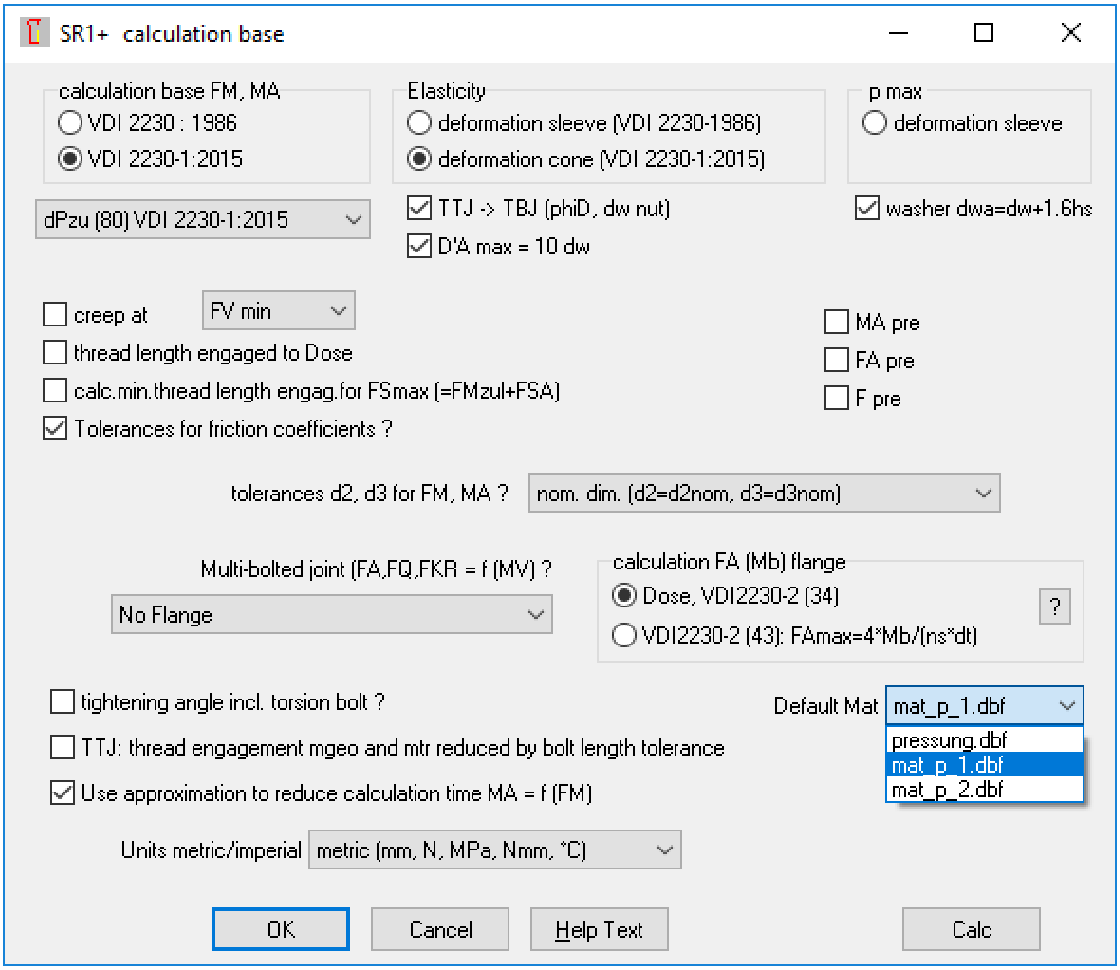


FED17 - Print mandrel and sleeve for magazine spring
Mandrel and bore for magazine springs can be generated as an STL file and produced with a 3D printer now.
You can also enter the setting length under “Edit \ Production drawing” in FED17 now.



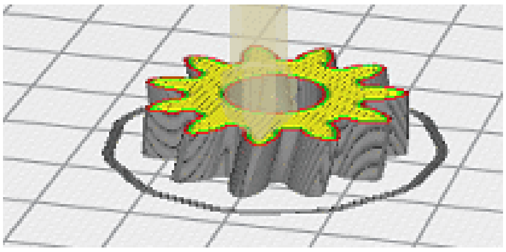
FED1..17: Warnings for fatigue strength diagram for hot formed springs
In EN 13906, there is only one fatigue strength diagram for hot coiled springs: for hot rolled steels according to EN 10089 with ground or peeled surface, shot blasted. Unlike cold-formed springs, the spring is fatigue strength safe in 2 million cycles, not 10 million like cold-formed springs.
Conversely, a shorter life is calculated from dynamic shear stress: If the allowable variation of stress for fatigue strength is slightly exceeded, then the life is not a little less than 10 million load ccycles, but less than 2 million cycles.
The fatigue 2E6 load cycling diagram does not automatically apply to hot formed springs and / or EN10089 spring bars, it must be configured under "Edit \ Calculation Method". There are now 2 new alerts as hint for possibly inappropriate setting:
Warning: EN10089 fatigue 2E6 if hot formed or material EN10089, but fatigue diagram 1E7.
Warning: Fatigue 1E7> <2E6? if cold-formed spring, but fatigue strength 2E6 set.

SR1/SR1+: Configure default material database



When selecting the materials for clamping plates and nuts, you can choose between the database files pressung.dbf, mat_p_1.dbf and mat_p_2.dbf. The default setting can now be configured under “Edit \ Calculation Method” (Default Mat). If you want to use a database with your own material data, the best way is to use mat_p_1.dbf. This contains material data from VDI 2230: 2003, which you no longer need. If you have not yet used mat_p_1.dbf for previous calculations, you can delete and replace the existing records, otherwise you may append your own data to the bottom. Mat_p_2.dbf contains the materials from VDI 2230:2015, and pressung.dbf contains all old and new material data.

ZAR1+, ZAR5, ZAR6, ZAR7, ZAR8: Helical gears by means of 3D printer

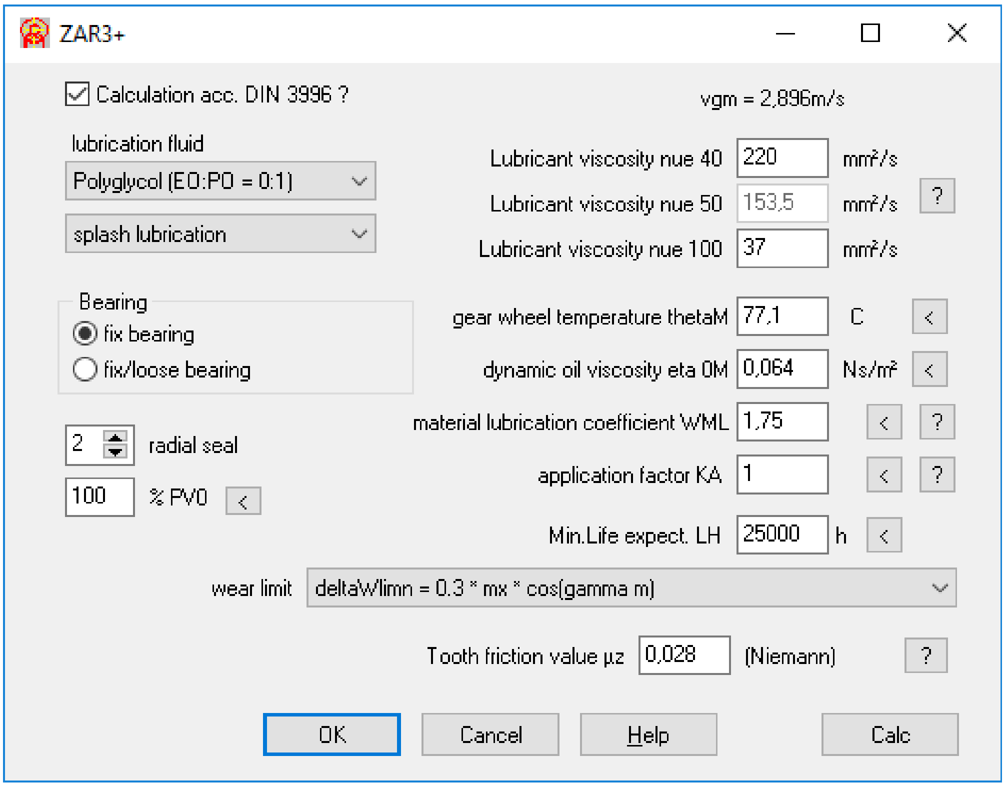


Up to now, only straight-toothed gears could be output as STL files for 3D printer production. This is now also possible for helical teeth. The helix is represented as a staircase function. Minimal stair width is the smallest possible layer thickness of the 3D printer. Suitable as an illustrative and functioning model, but rather unusable for practical use.

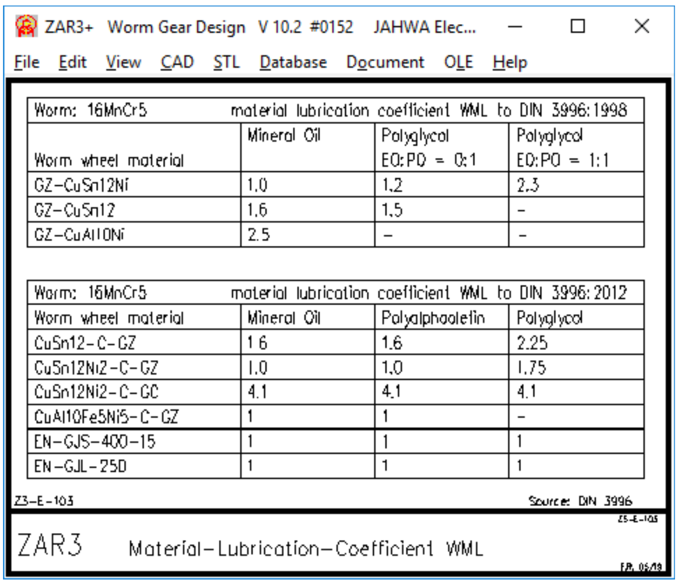
ZAR3+: Strength Calculation according to DIN 3996:2012-09

The strength of worm gears was previously calculated according to DIN 3996:1998-09. Now, the newer edition of 2012 has been integrated. ZAR3 + can now calculate strength and efficiency according to 3 methods: according to Niemann, according to DIN 3996: 1998 and according to DIN 3996: 2012. There were some changes on input:

- Polyalphaolefins were added to the lubricants
- Lubricant viscosity must now be entered for 40 ° C and 100 ° C, not for 50 ° C
- Enter the number of sealing rings for power loss PD
- Select the wear limit: 0.3 mx * cos (gamma m) or pointed tooth



Some help pictures had to be supplemented and updated because of changed characteristics in DIN 3996: 2012.



ZAR3+ Worm Gear Design V 10.2 #0152 JAHWA Elec...

File Edit View CAD STL Database Document OLE Help

Worm: 16MnCr5	material lubrication coefficient WML to DIN 3996:1998		
Worm wheel material	Mineral Oil	Polyglycol EO:PO = 0:1	Polyglycol EO:PO = 1:1
GZ-CuSn12Ni	1.0	1.2	2.3
GZ-CuSn12	1.6	1.5	-
GZ-CuAl10Ni	2.5	-	-

Worm: 16MnCr5	material lubrication coefficient WML to DIN 3996:2012		
Worm wheel material	Mineral Oil	Polyalphaolefin	Polyglycol
CuSn12-C-GZ	1.6	1.6	2.25
CuSn12Ni2-C-GZ	1.0	1.0	1.75
CuSn12Ni2-C-GC	4.1	4.1	4.1
CuAl10Fe5Ni5-C-GZ	1	1	-
EN-GJS-400-15	1	1	1
EN-GJL-250	1	1	1

Z3-E-103 Source: DIN 3996

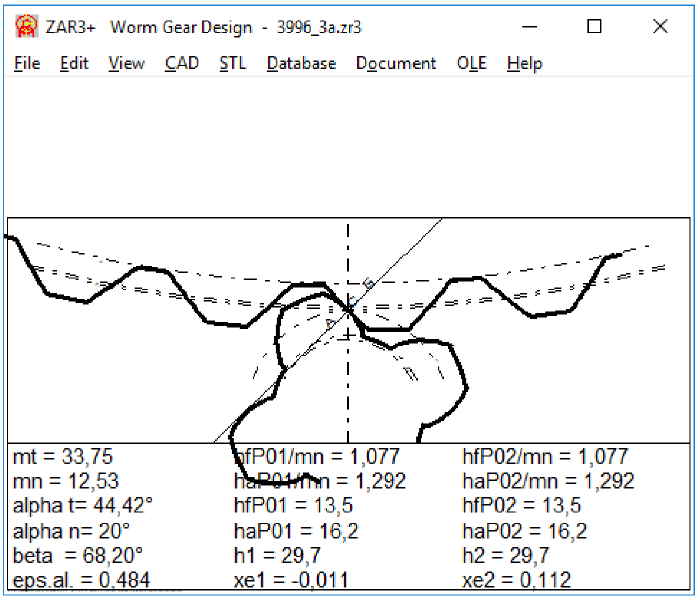
ZAR3 Material-Lubrication-Coefficient WML

Material coefficient YW	3996:1998	3996:2012
Worm wheel material	YW	YW
GZ-CuSn12 (CuSn12-C-GZ)	1.0	1.0
GZ-CuSn12Ni (CuSn12Ni2-C-GZ / GC)	0.95	0.95
GZ-CuAl10Ni (CuAl10Fe5Ni5-C-GZ)	1.1	1.1
EN-GJS-400-15 (GGG-40)	1.3	1.0
EN-GJL-250 (GG-25)	1.4	1.05

Shear Fatigue Strength tauFlimT		
worm gear material according to DIN	shear fatigue strength tauFlimT in N/mm²	reduced shear fatigue strength tauFlimT in N/mm²
GZ-CuSn12 (CuSn12-C-GZ)	92	82
GZ-CuSn12Ni	100	90
GZ-CuAl10Ni	128	120
EN-GJS-400 (GGG-40)	115	115
EN-GJL-25 (GG-25)	70	70
PA-12 cast	23	23

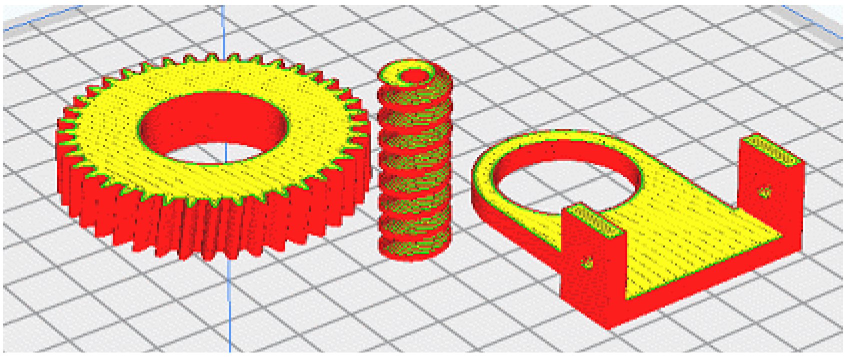
ZAR3+: Tooth contact axial

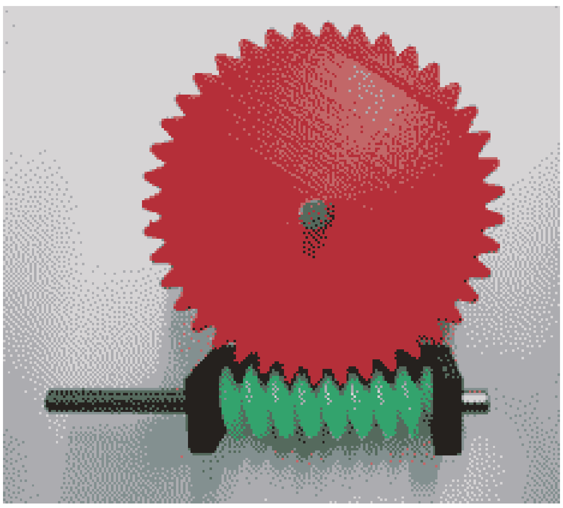
The meshing of worm and worm wheel can now also be represented in axial section in addition to the radial section. Also 1-tooth worms (ZI) are now displayed.



ZAR3 +: Worm gear model with 3D printer

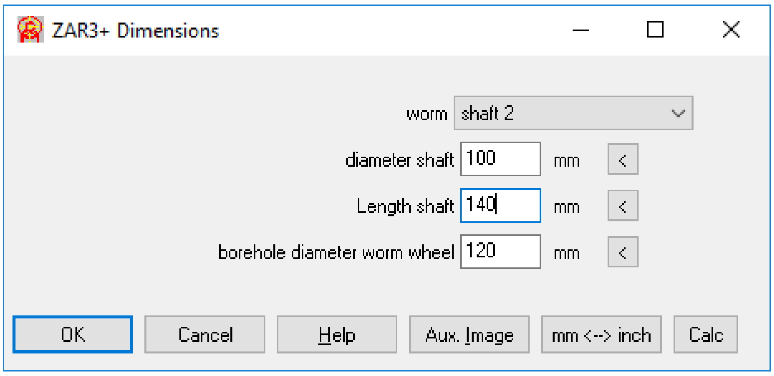
The calculated cylindrical worm can now also be output as STL file and create a model with 3D printer (ZI worm). The associated worm wheel can not be issued as globoide worm wheel, but at least as a helical gear wheel.





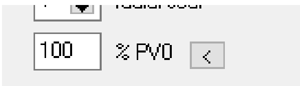
ZAR3 +: bore and shaft for worm and worm wheel

For worm and worm wheel you can enter a bore under "Dimensions 2". For the worm, it can be a shaft rather than a hole. "Shaft 1" is 1 shaft extension on the worm gear (for overhung bearing assembly), and "shaft 2" a shaft on both sides of the worm. The dimensions are used for STL files. When producing a worm with 3D printer, it is better to use only "bore" or "shaft1".



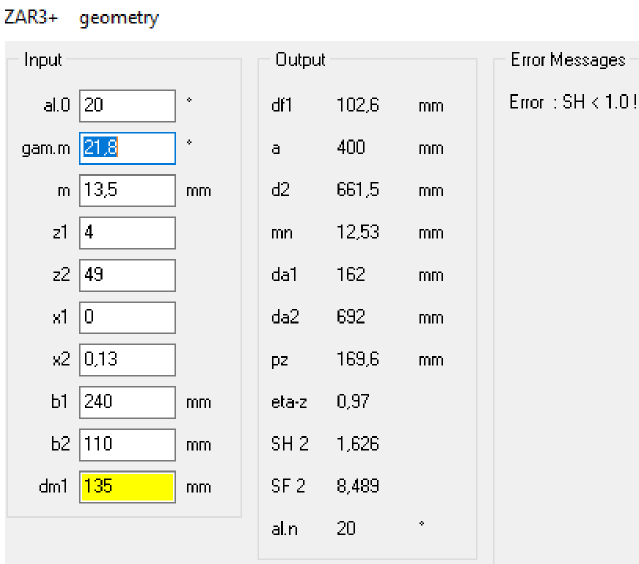
ZAR3 +: factor for no-load power loss PV0

The calculated no-load power loss PV0 sometimes seems too high for small, high-speed worm gears. The calculated no-load power loss at drive speed above 1000 rpm is often higher than the driving power, especially if plastic worm gears are used and therefore the drive power must be much smaller than in steel / bronze gear pairs. Efficiency and output power are then 0, and strength calculation is not possible. In order to be able to continue calculating or to adapt the calculation to measured values, one can now enter a factor for the consideration of the calculated no-load power loss PV0. Default is 100%.



ZAR3 +: Input dm1 for recalculation

The mean pitch diameter is actually a calculated value. If you change dm1, the module has been adjusted so far. The module stays the same now, instead the helix angle gamma_m changes.

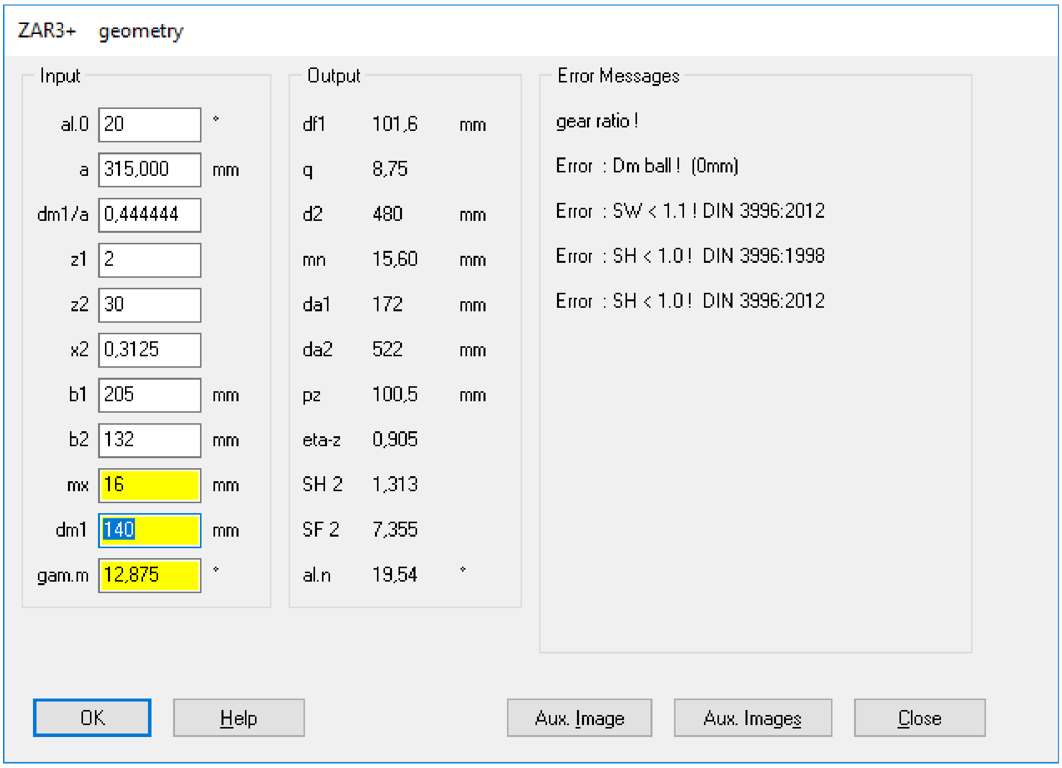


ZAR3 +: axial pressure angle of the worm alphax

The axial pressure angle of the worm alphax was incorrectly output (smaller than alphan instead of larger than alphan). This only had an effect on worm gears with ZA profile, because there is alphax = alpha0, and alphan is calculated.

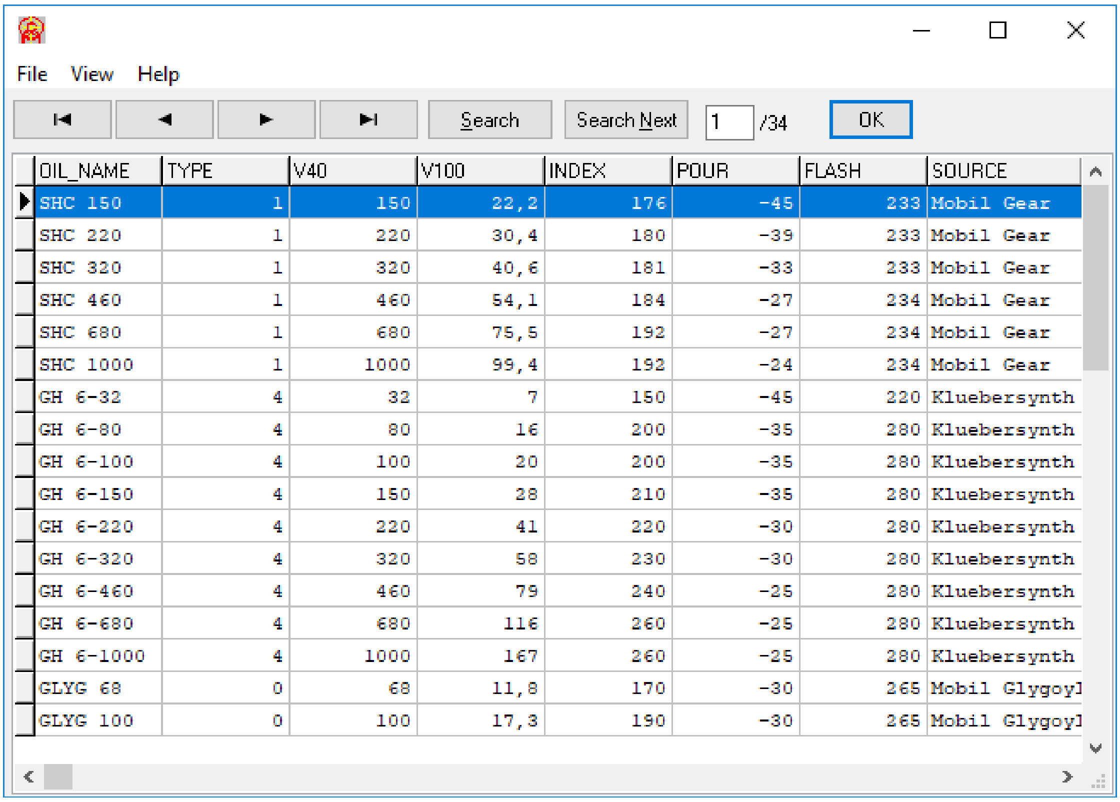
ZAR3 +: Input mx at “Dimensioning” changes either gamma_m or x2

If you enter the module at “Dimensioning”, dm1 and gamma_m are recalculated. If you want integers or standardized dimensions for m as well as for dm1, the profile shift x2 is calculated first. If -0.5> x2 <1.0, x2 is set, otherwise dm1 and gamma_m are recalculated as before.



ZAR3+: Lubricant database

For entering the lubricant viscosity at 40 ° C and 100 ° C, there is now a small lubricant database as input help.



OIL_NAME	TYPE	V40	V100	INDEX	POUR	FLASH	SOURCE
SHC 150	1	150	22,2	176	-45	233	Mobil Gear
SHC 220	1	220	30,4	180	-39	233	Mobil Gear
SHC 320	1	320	40,6	181	-33	233	Mobil Gear
SHC 460	1	460	54,1	184	-27	234	Mobil Gear
SHC 680	1	680	75,5	192	-27	234	Mobil Gear
SHC 1000	1	1000	99,4	192	-24	234	Mobil Gear
GH 6-32	4	32	7	150	-45	220	Kluebersynth
GH 6-80	4	80	16	200	-35	280	Kluebersynth
GH 6-100	4	100	20	200	-35	280	Kluebersynth
GH 6-150	4	150	28	210	-35	280	Kluebersynth
GH 6-220	4	220	41	220	-30	280	Kluebersynth
GH 6-320	4	320	58	230	-30	280	Kluebersynth
GH 6-460	4	460	79	240	-25	280	Kluebersynth
GH 6-680	4	680	116	260	-25	280	Kluebersynth
GH 6-1000	4	1000	167	260	-25	280	Kluebersynth
GLYG 68	0	68	11,8	170	-30	265	Mobil Glygoyl
GLYG 100	0	100	17,3	190	-30	265	Mobil Glygoyl

ZAR3+: Diagram a = f (gamma_m)

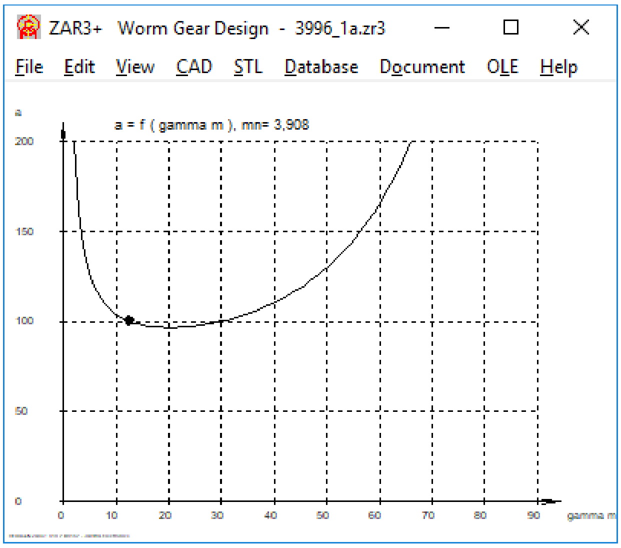
In the worm gear, gamma_m is the pitch angle of the worm and the helix angle of the worm wheel. The helix angle changes the center distance, or gamma_m (beta2) is calculated for a given center distance.

beta 2 = gamma_m

beta 1 = summa - beta 2 = 90 ° - beta 2 = 90 ° - gamma_m

a0 = mn / 2 * (z1 / cos (summa - beta2) + z2 / cos (beta2))

The function can now be represented as a diagram a = f (gamma_m), either for ”mn = const” or “mx = const”.



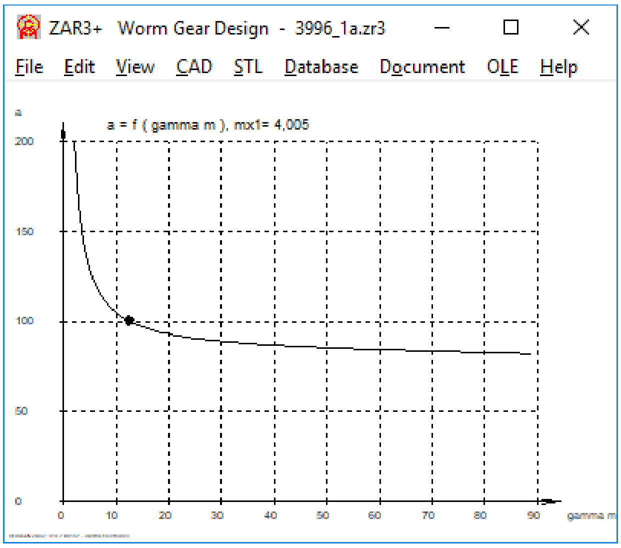
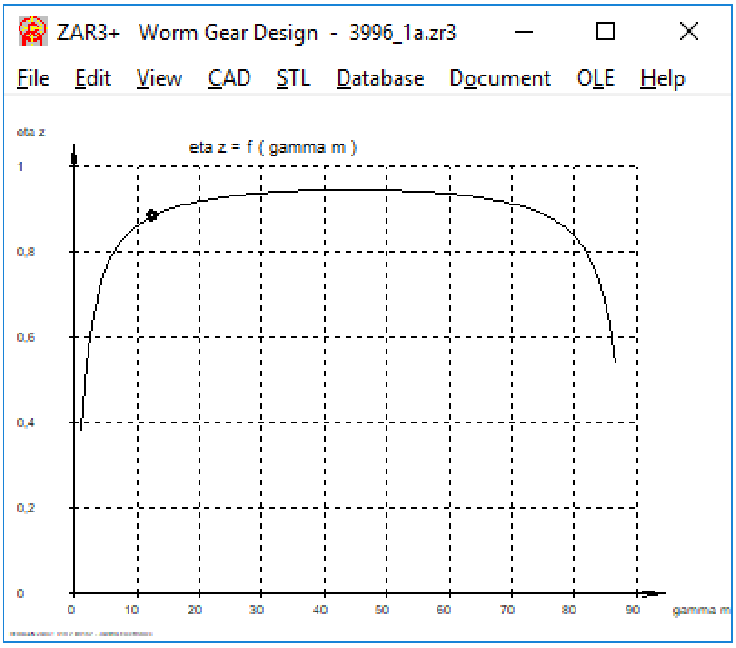


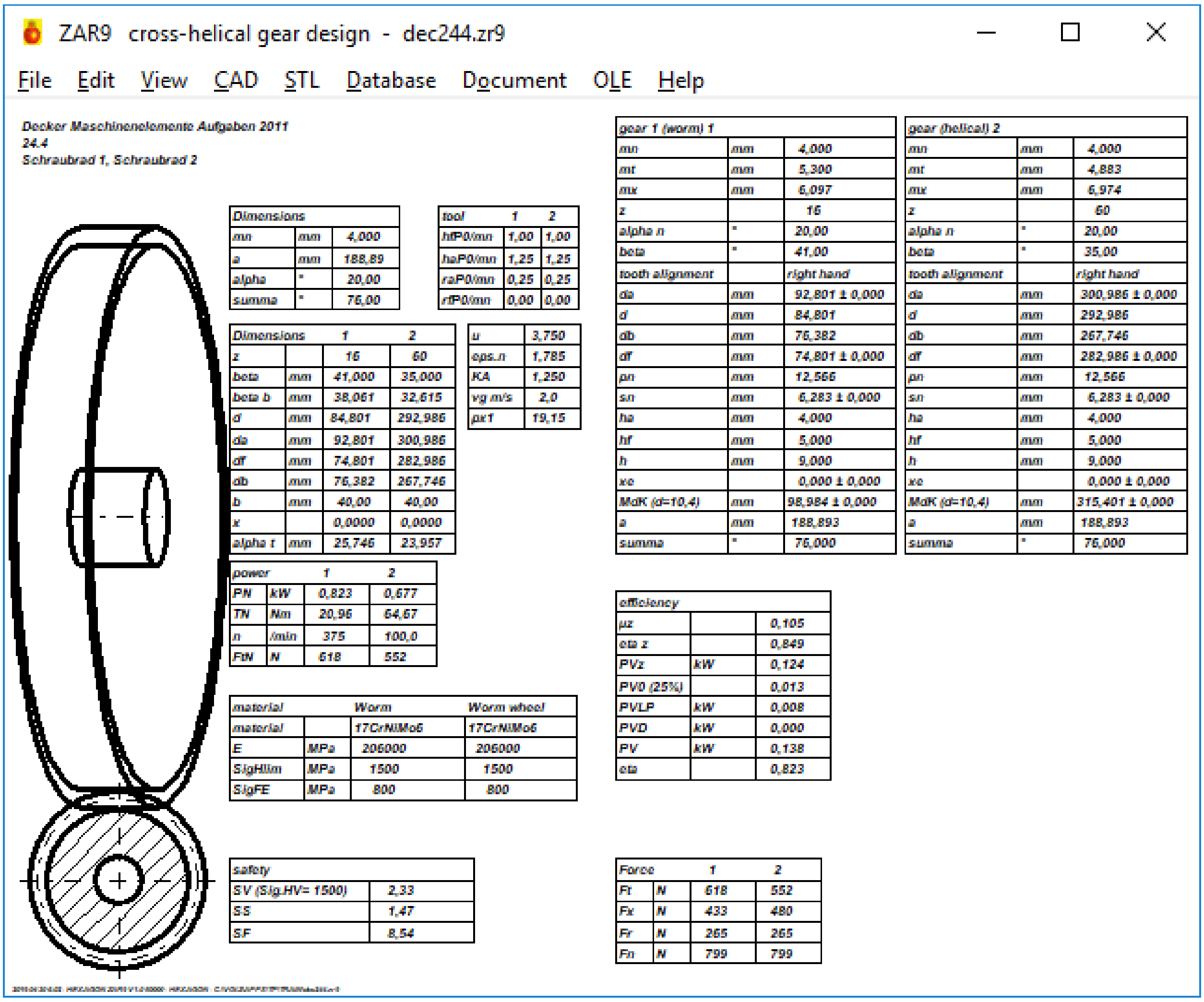
Diagram shows the smallest possible center distance, if mn remains constant. With worm gears, however, the axial modulus of the worm is normally specified, which corresponds to the tangential modulus of the worm wheel at 90 ° crossing angle (mx1 = mt2). Then mn = mt2 * cos (beta2) and a0 = mx1 / 2 * cos (beta2) * (z1 / cos (summa-beta2) + z2 / cos (beta2))

ZAR3+ Diagram eta = f (gamma_m)

The efficiency is also dependent on the helix angle. However, you can not increase the helix angle arbitrarily, otherwise the core diameter of the worm goes to zero.



ZAR9: software for cross-helical gear design



Dimensions		
mn	mm	4,000
a	mm	188,89
alpha	°	20,00
summa	°	76,00

tool	1	2
hfP0/mn	1,00	1,00
haP0/mn	1,25	1,25
raP0/mn	0,25	0,25
rfP0/mn	0,00	0,00

Dimensions		1	2
z		16	60
beta	mm	41,000	35,000
beta b	mm	38,061	32,615
d	mm	84,801	292,986
da	mm	92,801	300,986
df	mm	74,801	282,986
db	mm	76,382	267,746
b	mm	40,00	40,00
x		0,0000	0,0000
alpha t	mm	25,746	23,957

u	3,750
eps.n	1,785
KA	1,250
vg m/s	2,0
px1	19,15

power		1	2
PN	kW	0,823	0,677
TN	Nm	20,96	64,67
n	/min	375	100,0
FtN	N	618	552

material		Worm	Worm wheel
material		17CrNiMo6	17CrNiMo6
E	MPa	206000	206000
SigHlim	MPa	1500	1500
SigFE	MPa	800	800

safety	
SV (Sig.HV= 1500)	2,33
SS	1,47
SF	8,54

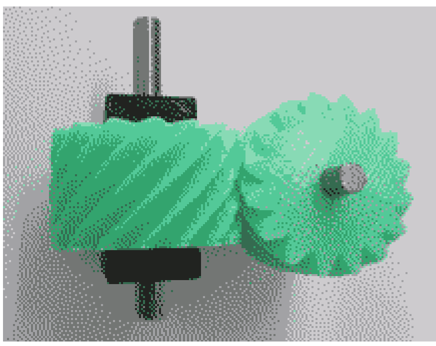
gear 1 (worm) 1		
mn	mm	4,000
mt	mm	5,300
mx	mm	6,097
z		16
alpha n	°	20,00
beta	°	41,00
tooth alignment		right hand
da	mm	92,801 ± 0,000
d	mm	84,801
db	mm	76,382
df	mm	74,801 ± 0,000
pn	mm	12,566
sn	mm	6,283 ± 0,000
ha	mm	4,000
hf	mm	5,000
h	mm	9,000
xe		0,000 ± 0,000
MdK (d=10,4)	mm	98,984 ± 0,000
a	mm	188,893
summa	°	76,000

gear (helical) 2		
mn	mm	4,000
mt	mm	4,883
mx	mm	6,974
z		60
alpha n	°	20,00
beta	°	35,00
tooth alignment		right hand
da	mm	300,986 ± 0,000
d	mm	292,986
db	mm	267,746
df	mm	282,986 ± 0,000
pn	mm	12,566
sn	mm	6,283 ± 0,000
ha	mm	4,000
hf	mm	5,000
h	mm	9,000
xe		0,000 ± 0,000
MdK (d=10,4)	mm	315,401 ± 0,000
a	mm	188,893
summa	°	76,000

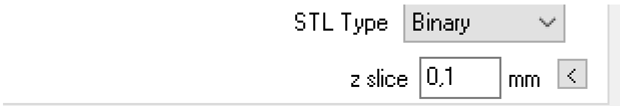
efficiency		
µz		0,105
eta z		0,849
PVz	kW	0,124
PV0 (25%)		0,013
PVLP	kW	0,008
PVD	kW	0,000
PV	kW	0,138
eta		0,823

Force		1	2
Ft	N	618	552
Fx	N	433	480
Fr	N	265	265
Fn	N	799	799

Soon we can provide a new software for cross-helical gear design. The dimensions of cross-helical gears are calculated similarly to worm gears, so that most dimensions for 90 ° axis angles can also be calculated with ZAR3 +. Instead of a line contact like a globoid worm wheel, there is only one point touch on the cross-helical gear. Therefore, in the cross-helical gear compared with a worm gear of the same dimensions, the load capacity is worse and the efficiency similarly poor.
Incidentally, ZAR3 + can also be used to calculate a worm gear that is more similar to a pair of cross-helical gears: enter the same number of teeth z1 and z2 and gamma_m = 45 °, results in the same dimensions of worm and worm wheel. When created with a 3D printer, the worm and worm wheel (as a helical wheel, not as a globoid wheel) are exactly the same.
There are several types of cross-helical gears: worm and helical gear with 90 ° axis angle as worm gear replacement, two cross-helical gear wheels with 90 ° axis angle, or the same with an axis angle between 30 ° and 90 °.



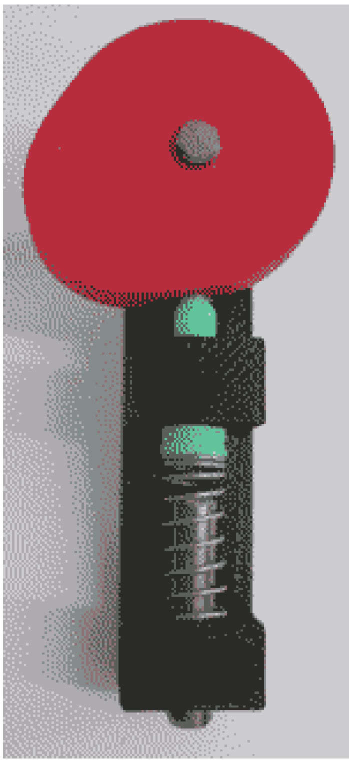
ZAR1+, ZAR3+,ZAR5,67,8,ZARXP, ZAR1W: Settings: z slice
Helical gears and worm gears are shown in layers. The layer thickness can now be configured under File \ Settings \ CAD. We suggest to configure the default layer thickness of your 3D printer as z_slice. Attention: If you reduce the layer thickness so that the STL model is displayed with smaller steps, the size of the STL file increases accordingly. In any case, the STL file of helical gears will be many times larger than that of spur gears. Helical gears and worms from the 3D printer can only be used to a limited extent, depending on the layer thickness, the slope is a step function with larger or smaller steps and corresponding unevenness. File \ Settings \ CAD:



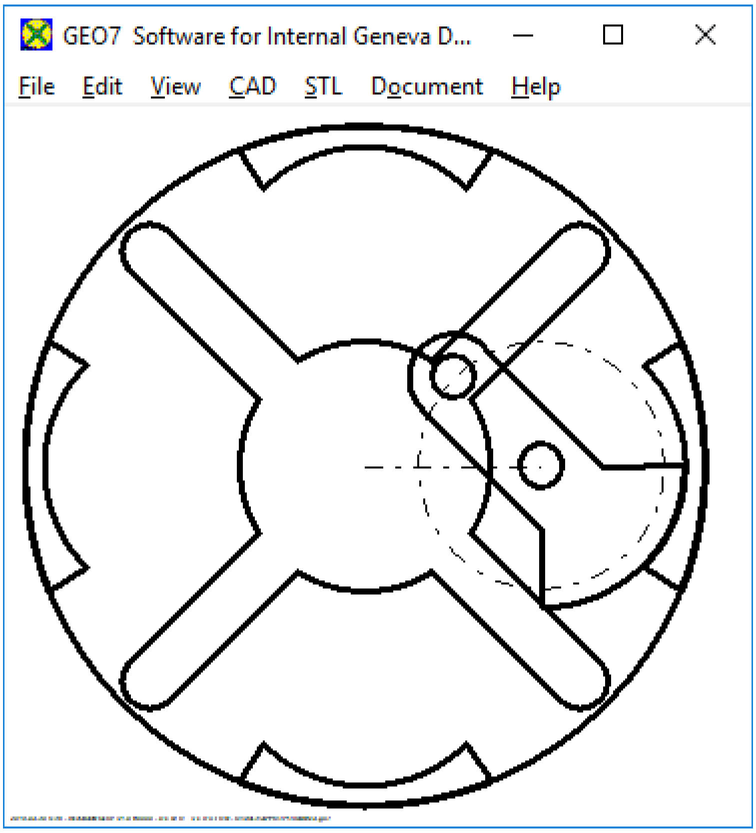
ZAR1W, ZAR1+: xe tolerance
The +/- tolerance of the generating profile shift factor xe had been displayed too large in the gear table. Since tolerance +/- from the mean value, half the value for the tolerance applies.

SR1 / SR1 +: Less warnings for missing database data for temperature dependency
When you enter a working temperature, you sometimes get warnings like "mat_p_re.dbf: material name?". This means that there are no material data for the temperature dependence of yield strength and Young's modulus. There are fields in the database for the values at 100 .. 700 ° C. If the entered working temperature is less than 100 ° C, these warnings will no longer appear in the future because at 100 ° C modulus of elasticity and yield strength change only slightly. The most important influencing factor is anyway the temperature expansion coefficient alphaT, and this one is known for all materials.

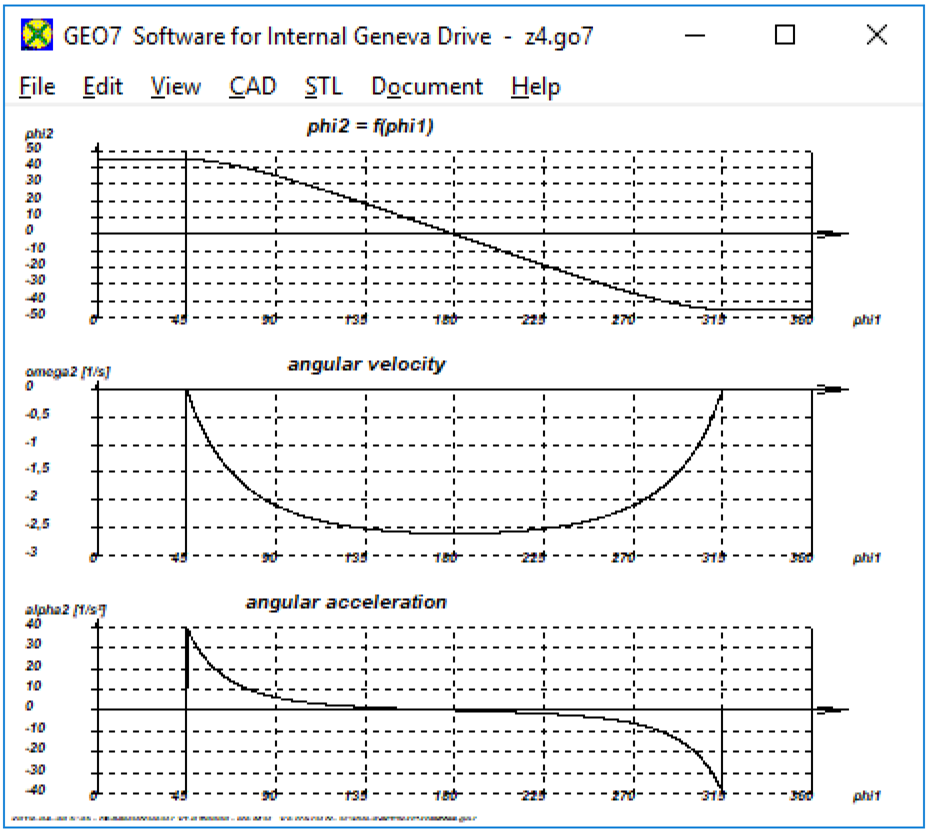
GEO4: create model with 3D printer
In addition to cams or cam discs, you can now also create plungers and a carrier plate as STL file and produce with 3D printer.



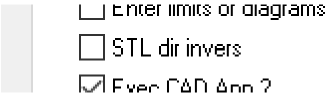
GEO7: Software for Internal Geneva Gears



GEO7 calculates stepper gear with internal Geneva wheel. Interior Maltese have a long switching time and a short rest time compared to external Maltese gears. In a 4-beem external Geneva gear, the switching angle is 90 ° and the locking angle is 270 °. In case of an internal Geneva drive, the reverse is true: switching angle 270 ° and locking angle 90 °.



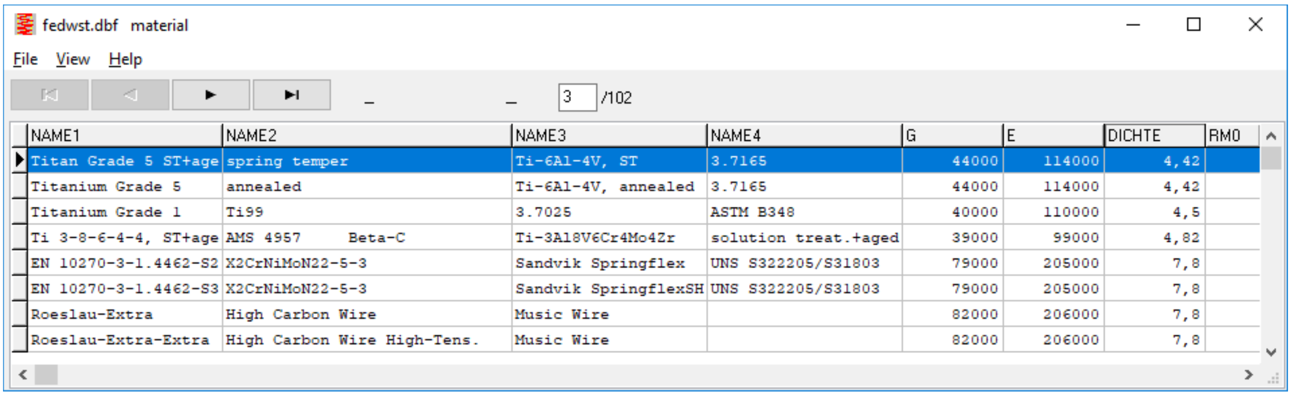
Reverse STL direction
Under "File \ Settings \ CAD" (STL Dir invers) you can now reverse the direction of the STL-3D objects if your program to open the STL files displays the 3D object in the wrong color or reports the wrong direction.



Change Licensee name: 40 Euro
The name of the licensee is fixed in the program and can not be changed by you. For updates, the name of the licensee usually remains unchanged. If you want to change your company name in the program as part of an update, because the name has changed or the company was merged or acquired, please order the name change for a fee of 40 Euros (plus the update price). Otherwise, the name of the licensee will remain unchanged in the new version. Maximum 30 characters are possible.

Key code problem with Windows 10 or network version
If you always need new key codes for your network version if the server or volume has been replaced or volume settings modified, but the path remained the same, you can update to a version with permanent key code, but your program path must also remain permanent. When updating, please specify the network path (UNC path, no logical drive), e.g. \\ourserver659\HEXAGON\, then you get an update with permanent code that does not change anymore (if the path does not change). Then you need new key codes for the last time. License agreement then please also update with UNC path and copy back as a pdf file.
A similar problem exists for single-user licenses under Windows 10. For large Windows updates, Windows reduces the usable size of the hard disk in favor of an invisible Microsoft partition. The only solution is to install the software not on the system partition C:, but on another partition or hard disk. If your PC has an SSD disk and a large hard disk, do not install HEXAGON software on the SSD if Windows is installed there. Better install it on the large disk. Another option is to install HEXAGON software on an external hard drive. Then HEXAGON software remains on the external hard drive, even if computer changes, without needing new key codes.

Did you know ? Show database sorted



NAME1	NAME2	NAME3	NAME4	G	E	DICHTE	RM0
Titan Grade 5 ST+age	spring temper	Ti-6Al-4V, ST	3.7165	44000	114000	4,42	
Titanium Grade 5	annealed	Ti-6Al-4V, annealed	3.7165	44000	114000	4,42	
Titanium Grade 1	Ti99	3.7025	ASTM B348	40000	110000	4,5	
Ti 3-8-6-4-4, ST+age	AMS 4957 Beta-C	Ti-3Al8V6Cr4Mo4Zr	solution treat.+aged	39000	99000	4,82	
EN 10270-3-1.4462-S2	X2CrNiMoN22-5-3	Sandvik Springflex	UNS S322205/S31803	79000	205000	7,8	
EN 10270-3-1.4462-S3	X2CrNiMoN22-5-3	Sandvik SpringflexSH	UNS S322205/S31803	79000	205000	7,8	
Roeslau-Extra	High Carbon Wire	Music Wire		82000	206000	7,8	
Roeslau-Extra-Extra	High Carbon Wire High-Tens.	Music Wire		82000	206000	7,8	

All databases can be sorted by any column by clicking with the right mouse button in the title field (here "DENSITY" or “DICHTE”)

HEXAGON PRICE LIST 2019-05-01

PRODUCT	EUR
DI1 Version 1.2 O-Ring Seal Software	190.-
DXF-Manager Version 9.1	383.-
DXFPLOT V 3.2	123.-
FED1+ V30.9 Helical Compression Springs incl. spring database, animation, relax., 3D,..	695.-
FED2+ V21.3 Helical Extension Springs incl. Spring database, animation, relaxation, ...	675.-
FED3+ V21.1 Helical Torsion Springs incl. prod.drawing, animation, 3D, rectang.wire, ...	600.-
FED4 Version 7.7 Disk Springs	430.-
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FED6 Version 16.8 Nonlinear Cylindrical Compression Springs	634.-
FED7 Version 13.8 Nonlinear Compression Springs	660.-
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FED9 Version 6.3 Spiral Spring	394.-
FED10 Version 4.3 Leaf Spring	500.-
FED11 Version 3.5 Spring Lock and Bushing	210.-
FED12 Version 2.6 Elastomer Compression Spring	220.-
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FED14 Version 2.2 Helical Wave Spring	395.-
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FED16 Version 1.3 Constant Force Spring	225.-
FED17 Version 1.9 Magazine Spring	725.-
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GEO3 V3.3 Hertzian Pressure	205.-
GEO4 V5.2 Cam Software	265.-
GEO5 V1.0 Geneva Drive Mechanism Software	218.-
GEO6 V1.0 Pinch Roll Overrunning Clutch Software	232.-
GEO7 V1.0 Internal Geneva Drive Mechanism Software	219.-
GR1 V2.2 Gear construction kit software	185.-
HPGL-Manager Version 9.1	383.-
LG1 V6.6 Roll-Contact Bearings	296.-
LG2 V3.0 Hydrodynamic Plain Journal Bearings	460.-
SR1 V23.4 Bolted Joint Design	640.-
SR1+ V23.4 Bolted Joint Design incl. Flange calculation	750.-
TOL1 V12.0 Tolerance Analysis	506.-
TOL2 Version 4.1 Tolerance Analysis	495.-
TOLPASS V4.1 Library for ISO tolerances	107.-
TR1 V6.0 Girder Calculation	757.-
WL1+ V21.3 Shaft Calculation incl. Roll-contact Bearings	945.-
WN1 V12.1 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 5.5 Parallel Key Joints to DIN 6885, ANSI B17.1, DIN 6892	245.-
WN4 V 4.8 Involute Splines to ANSI B 92.1	276.-
WN5 V 4.8 Involute Splines to ISO 4156 and ANSI B 92.2 M	255.-
WN6 V 3.1 Polygon Profiles P3G to DIN 32711	180.-
WN7 V 3.1 Polygon Profiles P4C to DIN 32712	175.-
WN8 V 2.3 Serration to DIN 5481	195.-
WN9 V 2.3 Spline Shafts to DIN ISO 14	170.-
WN10 V 4.2 Involute Splines to DIN 5482	260.-
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WN12 V 1.1 Face Splines	256.-
WNXE V 2.2 Involute Splines - dimensions, graphic, measure	375.-
WNXK V 2.1 Serration Splines - dimensions, graphic, measure	230.-
WST1 V 10.2 Material Database	235.-
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PACKAGES	EUR
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HEXAGON Complete Package (All Programs)	12,900.-

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Language Version:
- **German and English :** all Programs
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- **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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