HEXAGON Info 150 March / April 2015

by Fritz Ruoss

25 Years HEXAGON GmbH

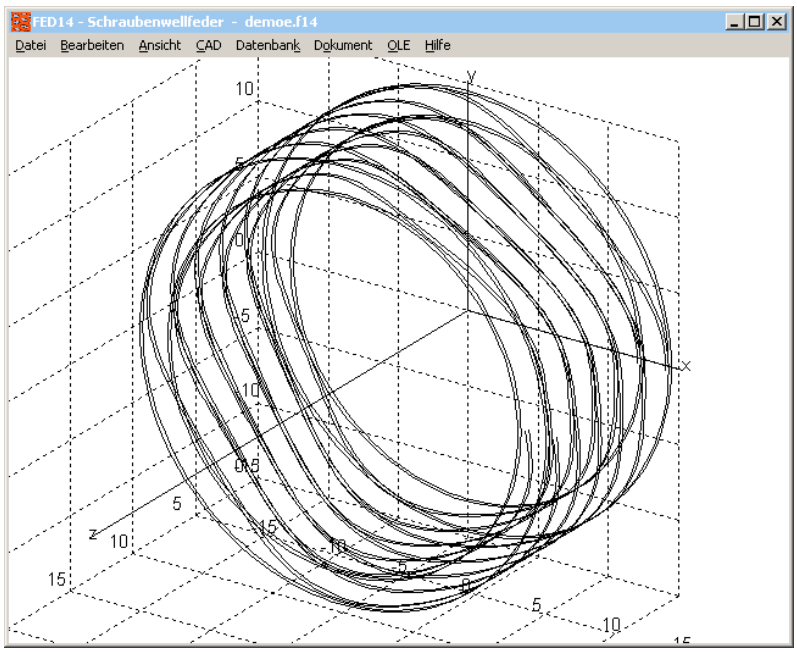
Info letter 150, with 6 info letters in one year, makes 25 years HEXAGON info letters - and 25 years ago, in April 1990, the HEXAGON Industriesoftware GmbH was founded. Since then, customers are informed every two months about HEXAGON Software news.

The first software, TOL1 for tolerance analysis, originated even 3 years before in 1987, provided by Fritz Ruoss engineering office. At that time, no Windows and no internet existed. The calculation programs ran under MS-DOS, system requirement was a IBM compatible personal computer with 512 kB RAM and floppy disk drive 5.25"/360 kB.

28 years later, more than 2500 customers with more than 10,000 licenses trust in calculations done by HEXAGON software.

With the 25th anniversary, we provide two new programs: FED14 for helical wave springs and FED15 for simple leaf springs.

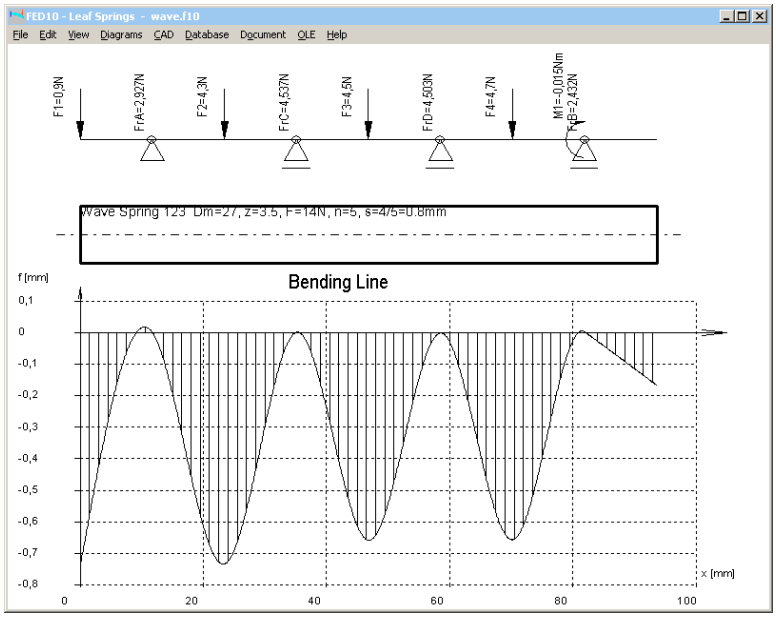
FED14 - New Software for Helical Wave Springs



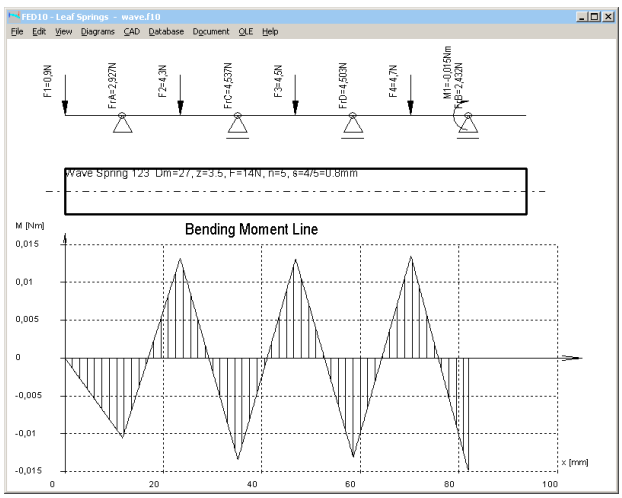
Helical wave springs are calculated like open wave washers with several turns. Crest of the waves must meet the crest of the next turn, therefore the number of waves per turn must always be x.5. Ideally, the crests of the waves should be welded together with the next turn waves to avoid the waves shifting under load, and crest of the waves slide in the valley of the next turn wave. To keep the distance between the crests relative high, number of waves per turn is only 2.5 or 3.5 or maximum 4.5. By friction and the effect as mentioned above, helical wave springs also appear a tolerance dependent, non-calculable hysteresis effect.

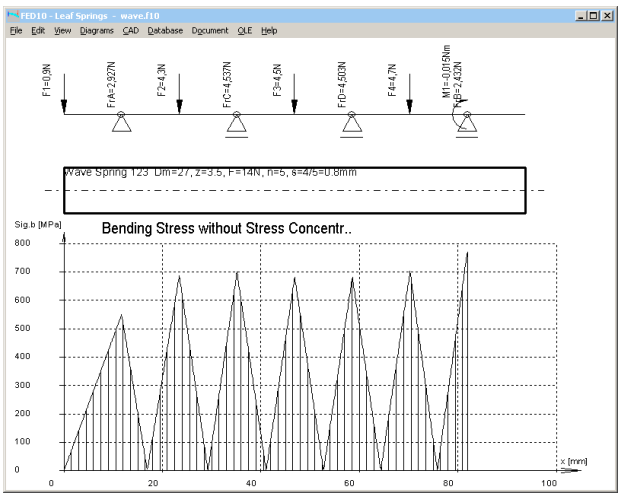
Spring load can be calculated from bending of the waves. Spring load caused by torsion of the helical spring flat is negligible small.

Advantage of helical wave springs compared with helical compression springs is a high load on a small volume. But as precision springs, helical wave springs are rather unsuitable.
For calculation, uncoiled helical wave spring can be calculated like a leaf spring with z bearings:
$s = F * L^3 / (16 * E * b * t^3 * N\text{^}4)$
with $L = pi * D * n$
$N = n * z$
n = number of turns, z = number of waves per turn, t = flat thickness, b = flat width, E = E module
FED10 leaf spring software can be used to calculate one turn of a helical wave spring, in example a coil with 3.5 waves. Spring flat is bedded on 4 bearings. Radial forces are bedding loads of the next coil. Forces have to be distributed so that deflection is equal for all waves. Left is spring end, and on the right side a bending moment of the first wave of the next turn has to be introduced.

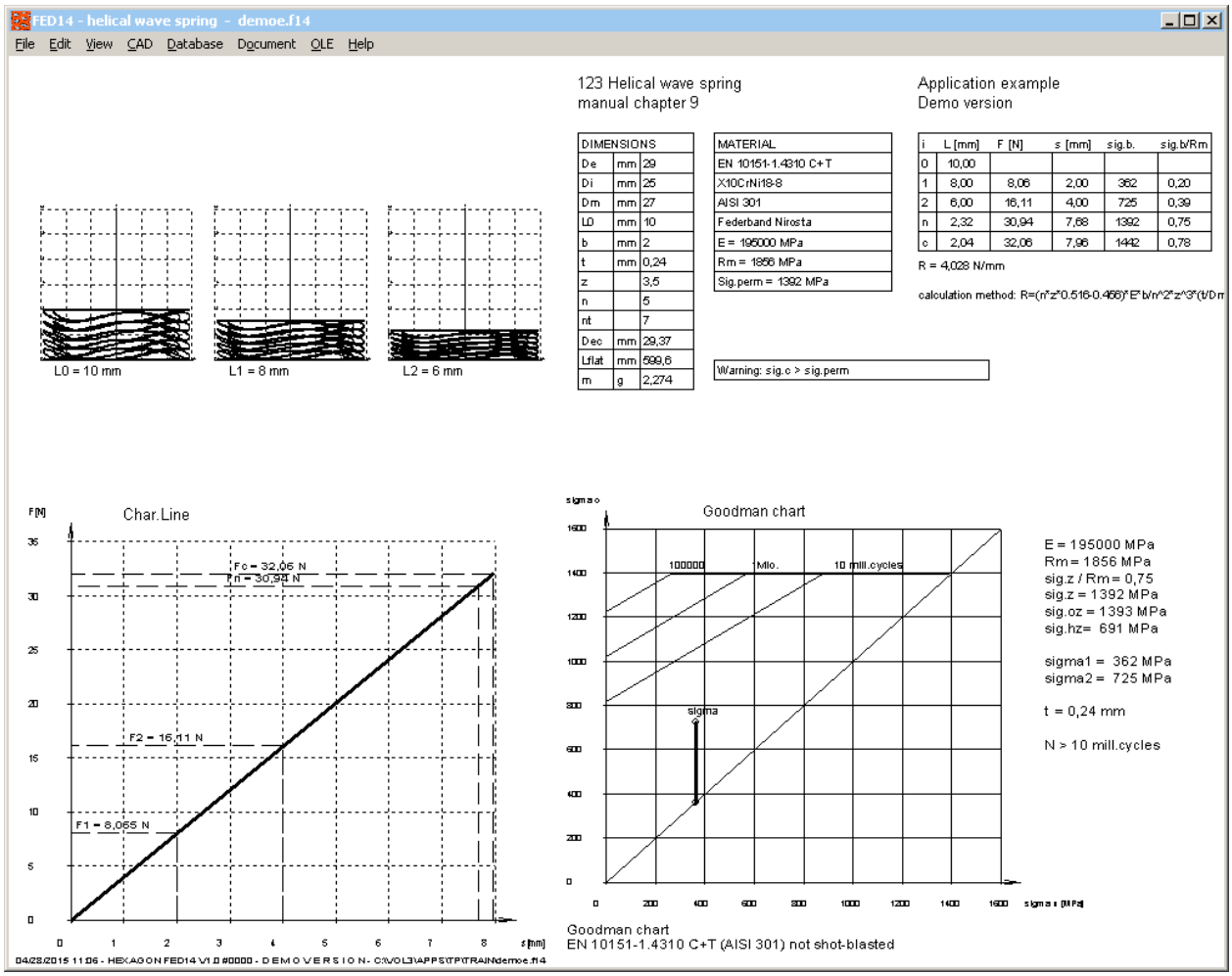


Curves of bending moment and bending stress by means of FED10
Maximum bending moment and bending stress is in the load introduction positions and in the bearing points, that are the crests of the waves.

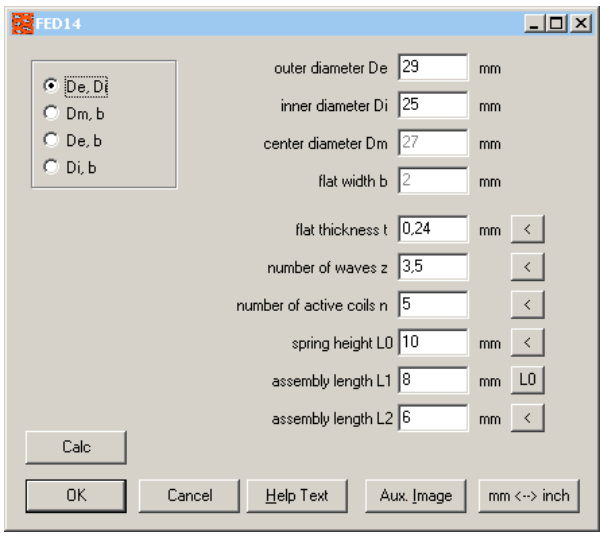


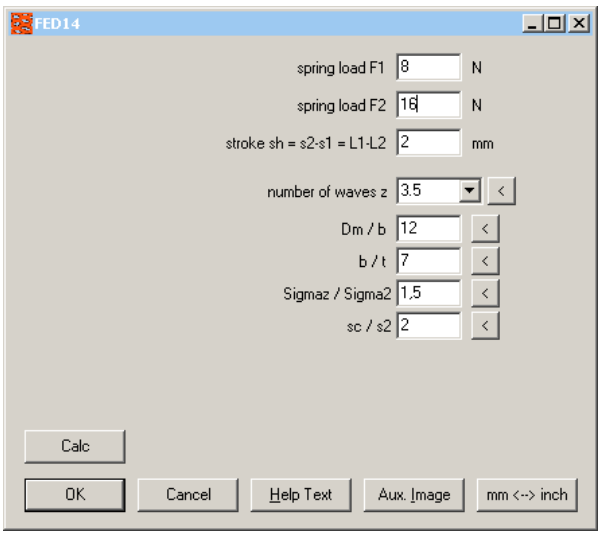


FED14 - Helical Wave Spring



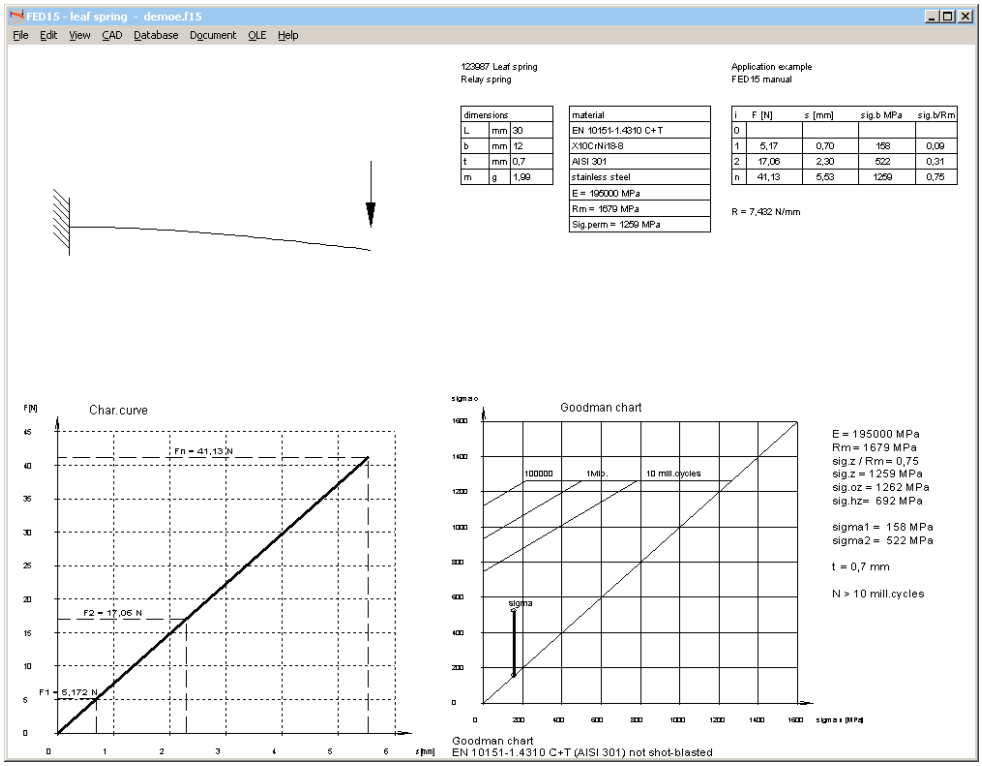
FED14 provides two methods of calculation: recalculation and pre-dimensioning. For recalculation, enter the dimensions and FED14 calculates loads and stress.



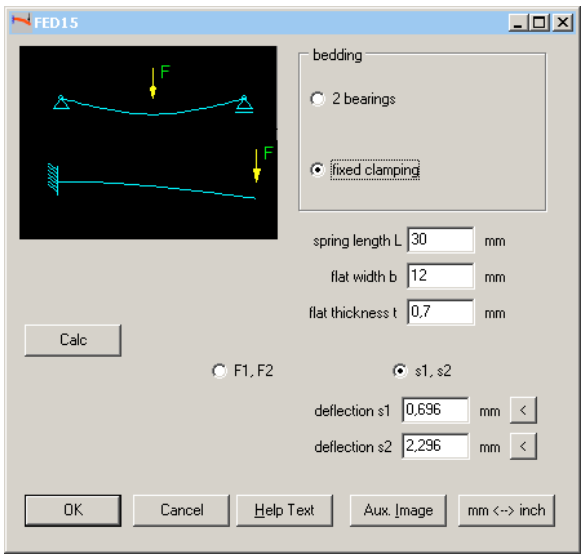


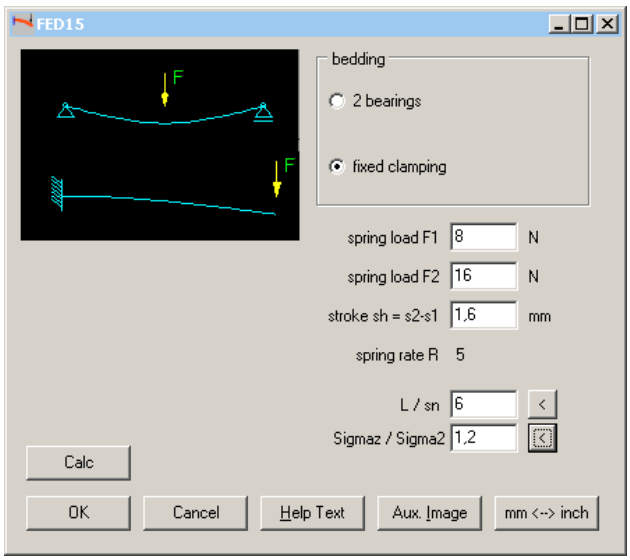
In pre-dimensioning, just input two spring loads and stroke, or only one spring load and deflection, and FED14 calculates dimensions. To vary results, you can edit number of waves, coil ratio, safety sigmaz/sigma2 or ratio of block deflection sc/s2.

FED15 – new software for simple leaf springs



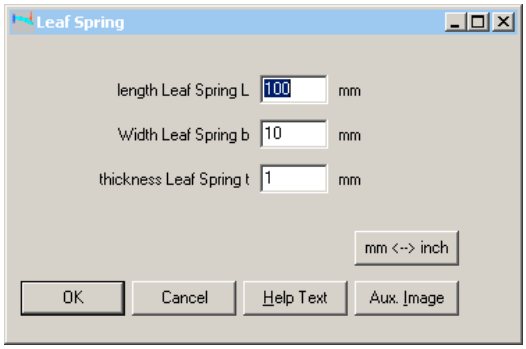
We already have another leaf spring software FED10 for complex leaf springs. FED10 calculates bending and stress in any position, and spring can be loaded with several radial and axial forces, path loads and bending moments.
In FED15, you can calculate simple leaf springs with constant rectangular cross-section and only one radial load by few clicks. In FED15, you can choose between "fixed clamping" and "2 bearings". Also the load introduction positions are predefined: for fixed clamping at spring end, and for two beddings in the middle of the spring. FED15 input with spring loads F1, F2 and spring deflection s1, s2 is similar than in other spring programs, whereas FED10 input rather is comparable with shaft calculation WL1+ and girder calculation TR1.



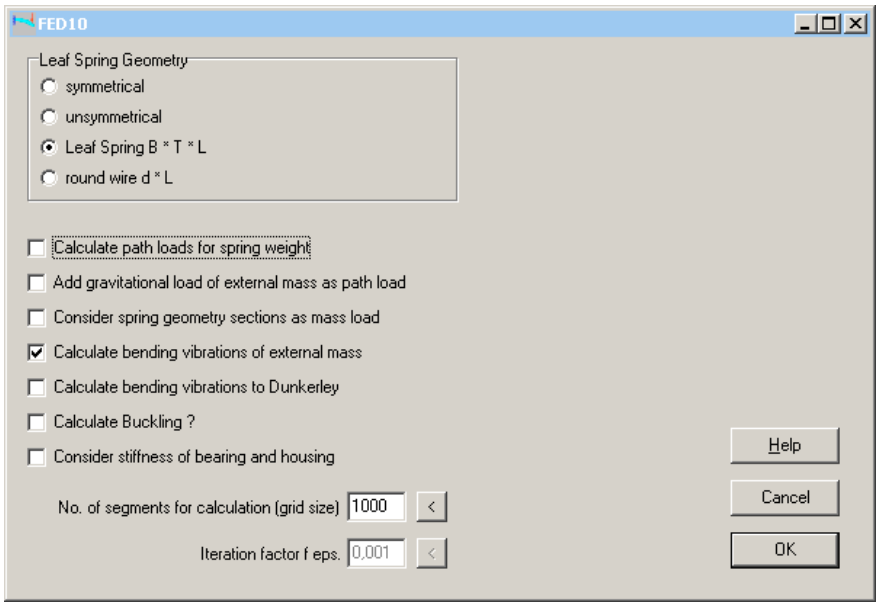


FED15 also provides a pre-calculation. Enter one or two loads and deflection, and FED15 calculates dimensions of the leaf spring. Modify ratio of spring length to deflection and safety sigmaz/sigam2 to vary leaf spring dimensions.

FED10 – simplified input for simple leaf springs

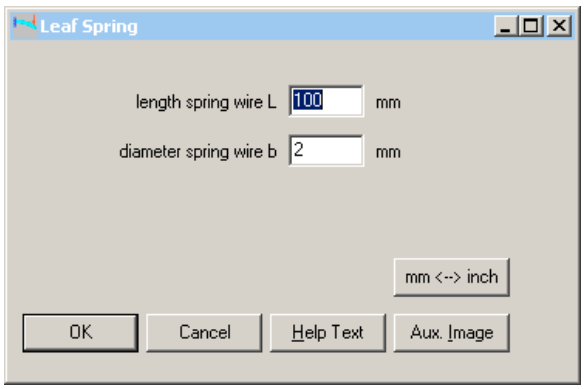


If the leaf spring geometry is just a piece of flat steel (as in FED15), you can now configure a simplified input for width, thickness and length of the leaf spring (at "Edit->Calculation method").



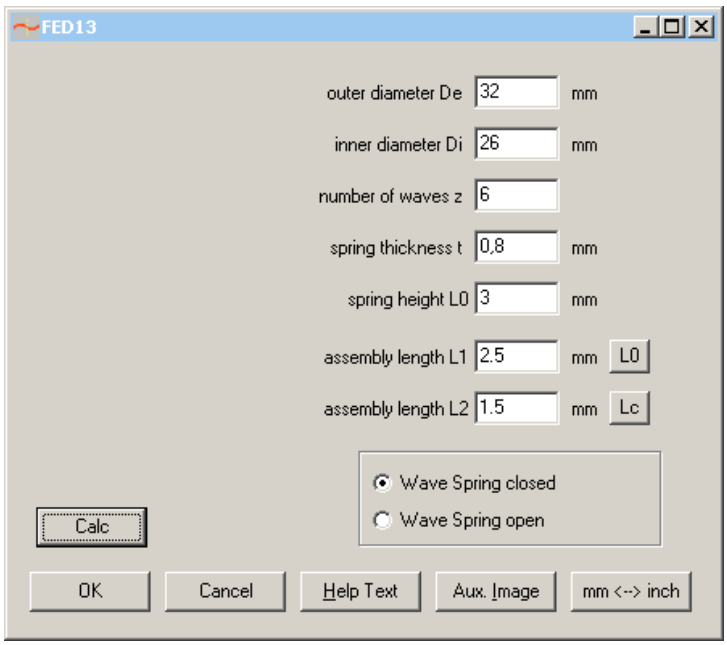
FED10 – calculate flexural springs of round wire

At "Calculation method" you can now configure "round wire" instead of flat. If so configured, you can enter wire diameter and spring length at geometry input.

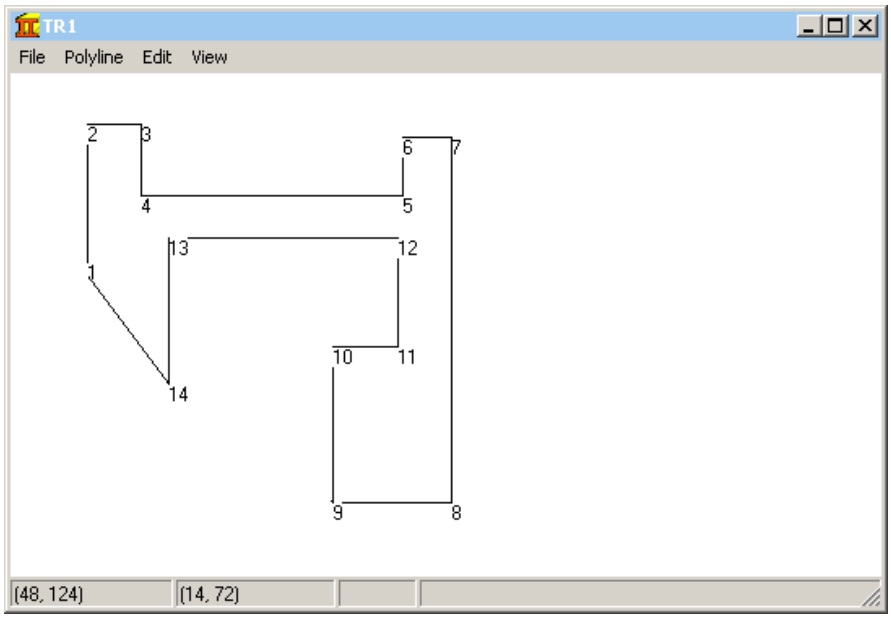


FED9, FED13: C_SIGMAB of fedw9wst.dbf used for Goodman Diagram
Permissible bending stress is 0.75 Rm (75% of tensile strength) by default. Bending stress coefficient (0.75) can be modified in the material database fed9wst.dbf. Modifications of C_SIGMAB now also influence Goodman diagram and lifetime calculation.

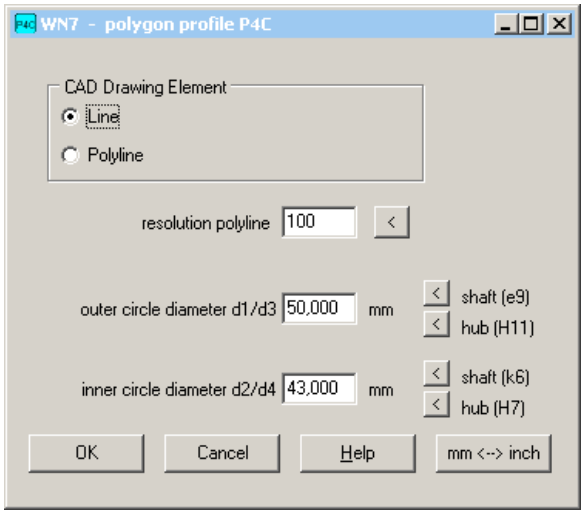
FED11, FED12, FED13 – Calc Button in input windows
A "Calc" button has been added in the input windows to ease varying of dimensions and check the changes in the background window with results.

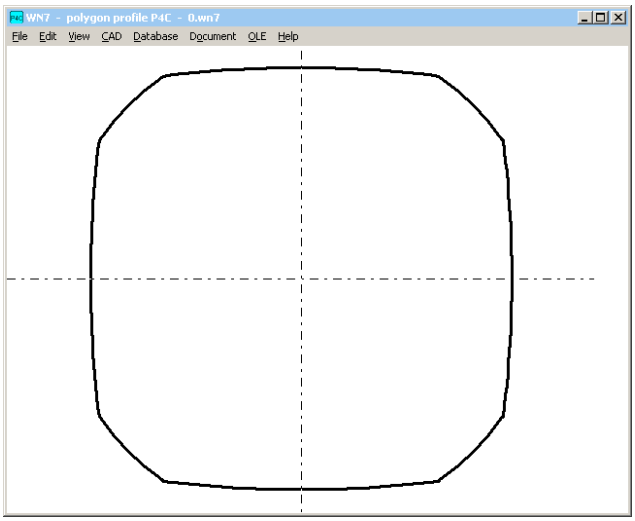


TR1 - Draw Profile
In TR1, you can select girder profile from database, or input of profile coordinates. As third option, you can now draw the profile by means of mouse or digitizer.



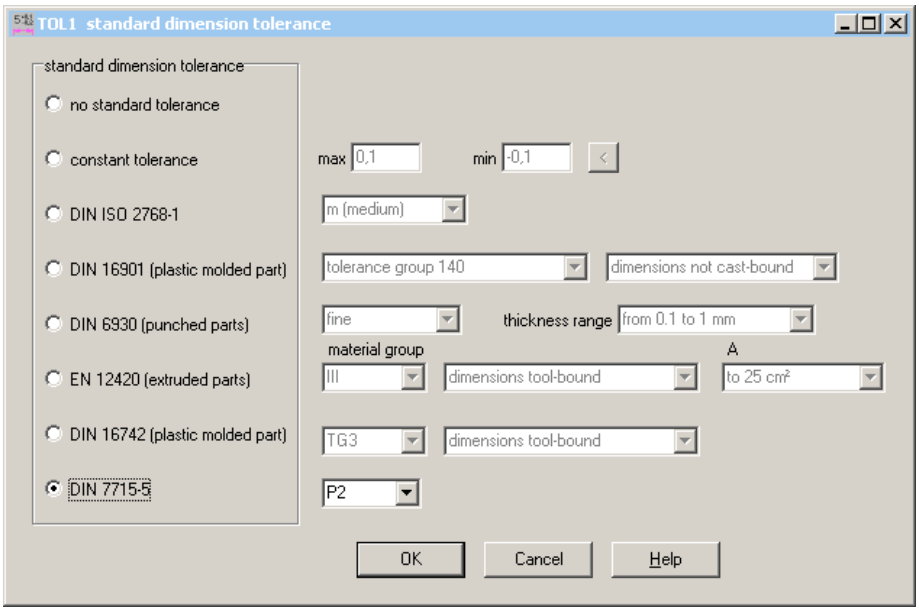
WN7 – Profile Drawings shaft/hub as cycloid curve





New at CAD->P4C, you can create true-scale P4C profile as DXF or IGES file and load in CAD. P4C profile is no continuous cycloid curve as in WN6. The P4C cycloid curve is limited by external diameter d1 (shaft profile) or d3 (hub profile) The P4C profile consists of 4 parts of a cycloid curve and 4 circular arcs with d1/d3. In DIN 32712, cycloid curve is approximated by radius r = d2/2 + 16e. P4C profile in FED14 can be generated as LINE/ARC or as POLYLINE, resolution of the cycloid curve can be configured. By means of the "<" buttons you can set d1/d3 and d2/d4 in tolerance center, or you can self define the values for inner and outer diameter of the profile.

TOL1 - Standard dimension tolerances according to DIN 7715 for elastomere parts



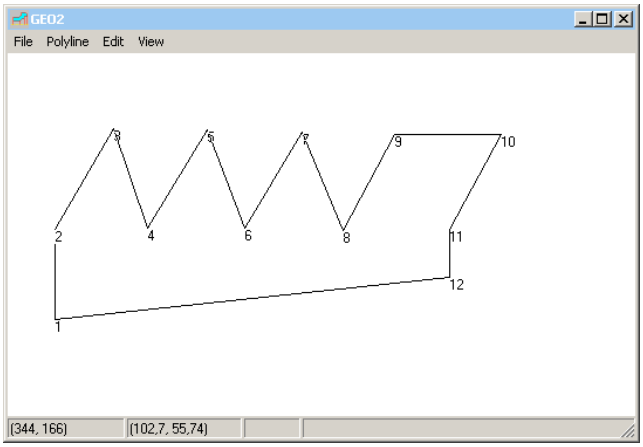
Tolerances according to DIN 7715 part 5 for elastomere parts has been added to the variety of selectable tolerances.

GEO2 – Pre-defined bodies of rotation

GEO2 calculates mass moment of inertia of any rotation body from the cross-section. For ball, cylinder, ball with bore, hollow cylinder, cone, frustrum, frustrum with bore, annulus and ellipsoid, input was simplified by entering only diameters and height instead of coordinates of rotation profile.

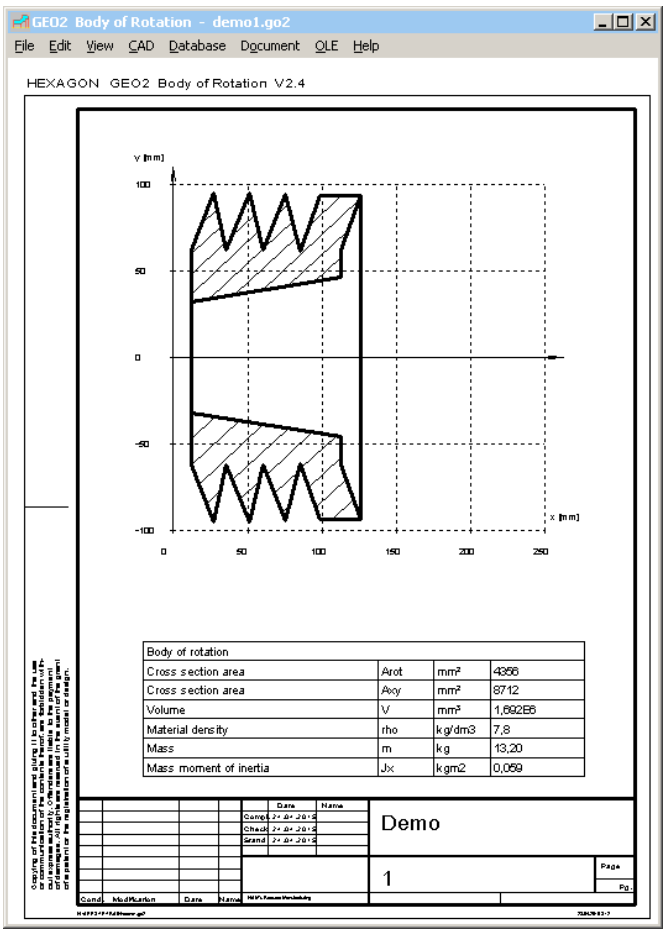
GEO2 - Draw cross-section of rotation

As alternative to input of the coordinates, you can now draw the cross-section of rotation area on the screen.



GEO2 – Full Section Drawing

Instead of half-section, production drawing shows now full section of the rotation body. Because the area of full section is double value, table with results lists now both, rotation area (Arot) and section of the body (Axy).



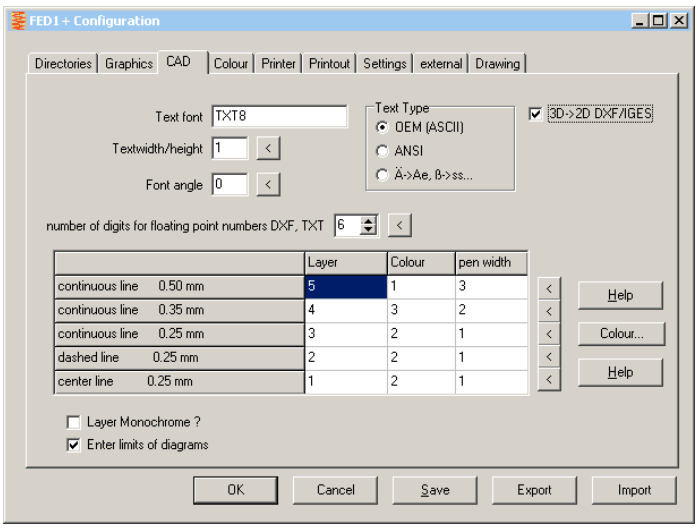
FED2+ Rectangular wire reduces bending stress in loops

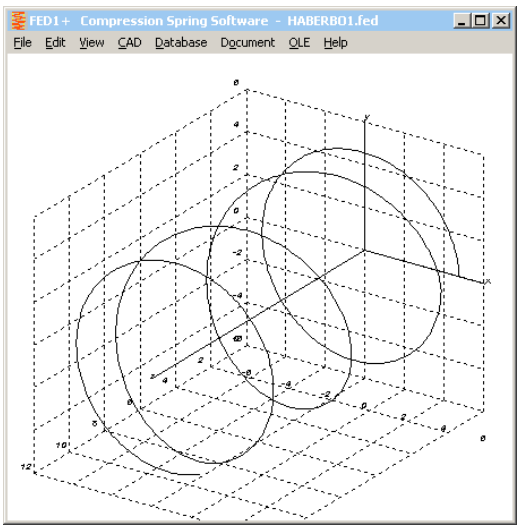
Normally, the maximum stressed area of a tension spring is the transition fillet of the coils into the loop with bending stress and tension. Therefore, the Quick3 view shows the Goodman diagram of bending stress instead of the Goodman diagram of shear stress. But there is one exception: If the extension spring is made of rectangular or elliptic wire, stress may be higher in the coils than in the transition radius to the loops. In this case, Quick3 and Quick4 View are now drawn with the Goodman diagram of shear stress.

SR1 – Differences with old calculations

If you open old calculations with a new versions of SR1 or SR1+, maybe you get error messages like „mzu<0.8P“ and warnings „mzu < 2P“ and „SG < 1.2“. In the old VDI 2230-1:2003, calculation of minimum engaged thread length considered a non-bearing thread length of 0.8 thread pitch. In the new version of 2014, non bearing thread length "mzu" can be self-defined (recommended 2 * P). In earlier versions of SR1 and SR1+, you could input non-bearable thread length, only the term "mzu" is new. And input of 0 caused no warning.
The warning "SG < 1.2" is a warning only, because VDI 2230 recommends a minimum safety of 1.2 for static radial load FQ and 1,8 for alternating FQ.

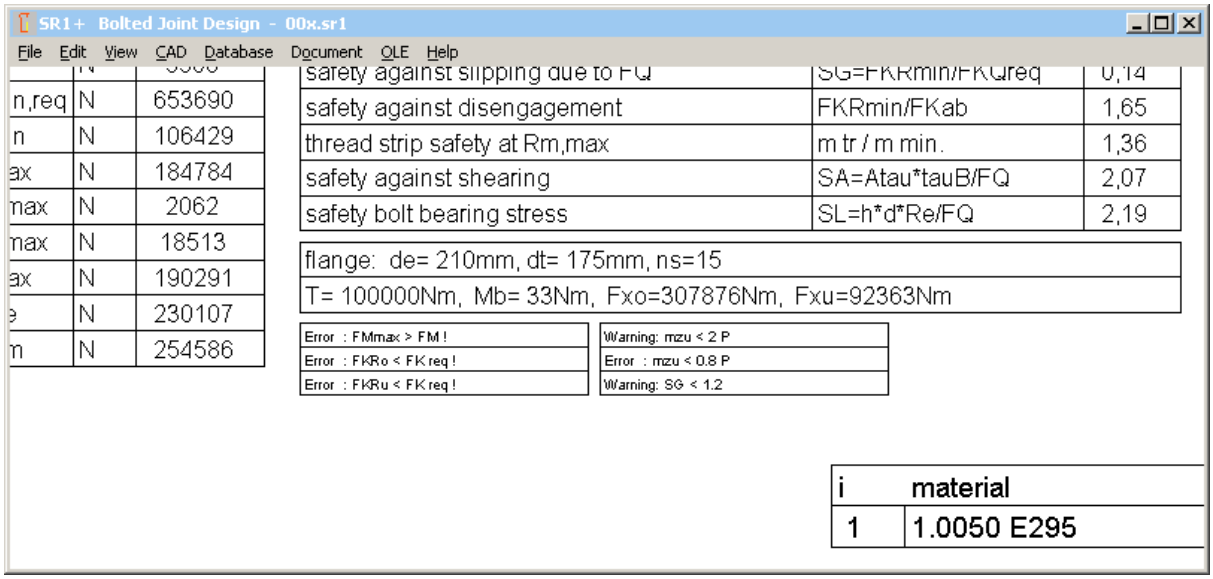
Configuration 3D -> 2D DXF-IGES



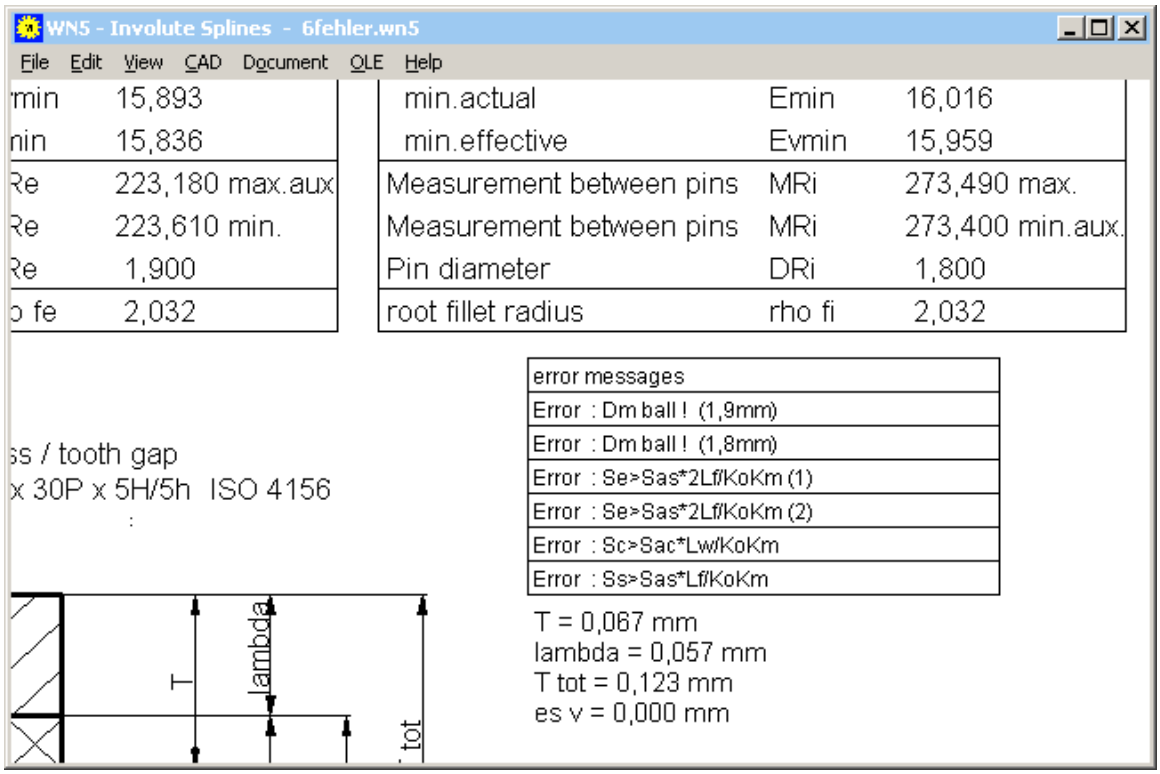


3D drawings are displayed on screen in a configurable xyz coordinate system, for DXF or IGES export, however, 3 dimensional with x,y,z coordinates. Now, you can configure at "File->Settings", if you want to export 3D drawings with xyz coordinates, or as 2D drawings in a coordinate system (same as the screen drawing). This option makes sense if 3D drawings are included in 2D drawings (production drawing, Quick3 view).

Table with error messages in Quick View



If too many error messages, overlapping with regular printout could occur. To avoid this, text height of error messages is reduced now, if too many error messages.



Floating Licenses: use various releases together

If you update your software, and want to use both, old and new version for a transition period, you simply have to rename the old program file, i.e. wsr1.exe into wsr1old.exe. All program files must be in the same folder, i.e. wsr1.exe with the new version, wsr1old.exe with the old version, and wsr1ger.exe with the German version. If you want to use different database files with the different versions, you have to define different "Start in" folders with different configuration files (wsr1.cfg)

PRICELIST 2015-05-01

PRODUCT	EUR
DI1 Version 1.1 O-Ring Seal Software	190,-
DXF-Manager Version 8.6	383,-
DXFPLOT V 3.0	123,-
FED1 Version 26.7 Calc.of Helical Compression Springs	491,-
FED1+ V26.7 Helical. Compression Springs incl. Spring Database, Animation, Relax., 3D,..	695,-
FED2 V 18.7 Calc.of Helical. Tension Springs	501,-
FED2+ V 18.7 Helical Tension Springs incl, Spring Database, Animation, Relaxation, ...	675,-
FED3+ V17.3 Helical Torsion Springs incl. Prod.drawing, Animation, 3D, Rectang.wire, ...	480,-
FED4 Version 6.4 Calc.of Disk Springs	430,-
FED5 Version 13.5 Conical Compression Springs	741,-
FED6 Version 14.1 Nonlinear Cyl. Compression Springs	634,-
FED7 Version 11.5 Nonlinear Compression Springs	660,-
FED8 Version 6.3 Torsion Bar Calculation	317,-
FED9 Version 5.5 Spiral Spring	394,-
FED10 Version 3.0 Complex Leaf Spring	500,-
FED11 Version 3.0 Spring Lock and Bushing	210,-
FED12 Version 2.3 Elastomere Compression Spring	220,-
FED13 Version 3.6 Wave Spring Washers	185,-
FED14 Version 1.0 Helical Wave Spring	395,-
FED15 Version 1.0 Simple Leaf Spring	180,-
GEO1+ V5.5 Cross Section Calculation incl. Profile Database	294.-
GEO2 V2.4 Moment of Inertia	194,-
GEO3 V3.1 Hertzian Pressure	205,-
GEO4 V3.8 Cam Software	265,-
HPGL-Manager Version 8.5	383,-
LG1 V6.2 Roll-Contact Bearing Calculation	296,-
LG2 V1.9 Hydrodynamic Plain Journal Bearings	460,-
SR1 V19.8 Bolted Joint Design	640,-
SR1+ V19.8 Bolted Joint Design incl. Flange calculation	750,-
TOL1 V11.5 Tolerance Analysis	506,-
TOL1CON V1.5 Conversion Program for TOL1	281,-
TOL2 Version 3.1 Tolerance Analysis	495,-
TOLPASS V4.1 Library for ISO tolerances	107,-
TR1 V3.6 Girder Calculation	757,-
WL1+ V19.5 Shaft Calculation incl. Roll-contact Bearings	945,-
WN1 Version 11.2 Cylindrical and Conical Press Fits	485,-
WN2 V 9.2 Involute Splines to DIN 5480	250,-
WN2+ V 9.2 Involute Splines to DIN 5480 and non-standard splines	380,-
WN3 V 5.2 Parallel Key Joints to DIN 6885, ANSI B17.1, DIN 6892	245,-
WN4 V 4.2 Involute Splines to ANSI B 92.1	276,-
WN5 V 4.2 Involute Splines to ISO 4156 and ANSI B 92.2 M	255,-
WN6 V 2.7 Polygon Profiles P3G to DIN 32711	180,-
WN7 V 2.0 Polygon Profiles P4C to DIN 32712	175,-
WN8 V 1.7 Serration to DIN 5481	195,-
WN9 V 1.8 Spline Shafts to DIN ISO 14	170,-
WN10 V 3.5 Involute Splines to DIN 5482	260,-
WN11 V 1.2 Woodruff Key Joints	240,-
WST1 V 9.2 Material Database	235,-
ZAR1+ V 23.6 Spur and Helical Gears incl. Database, Load Spectrum	1115,-
ZAR2 V7.2 Spiral Bevel Gears to Klingelnberg	792,-
ZAR3 V8.4 Worm Gears	404,-
ZAR3+ V8.4 Worm Gears incl. Profile drawings, variable tooth height, OPD measure	620,-
ZAR4 V3.6 Non-circular Spur Gears	1610,-
ZAR5 V8.3 Planetary Gearings	1355,-
ZAR6 V3.2 Straight/Helical/Spiral Bevel Gears	585,-
ZARXP V1.9 Involute Profiles - Calculation, Graphic, Measuring	275,-
ZAR1W V1.3 Gear Wheel Dimensions, Tolerances, Measuring	450,-
ZM1.V2.1 Chain Gear Calculation	326,-

Packages

PACKAGES	EUR
HEXAGON Mechanical Engineering Package (TOL1, ZAR1+, ZAR2, ZAR3+, ZAR5, ZAR6, WL1+, WN1, WN2+, WN3, WST1, SR1+, FED1,+, FED2+, FED3+, FED4, ZARXP, HAERTE, TOLPASS, LG1, DXFPLOT, GEO1+, TOL2, TOL1CON, GEO2, GEO3, ZM1, WN6, WN7, LG2, FED12, FED13, WN8, WN9, WN11, DI1, FED15)	8,500.-
HEXAGON Mechanical Engineering Base Package (ZAR1+, ZAR3+, ZAR5, ZAR6, WL1+, WN1, WST1, SR1+, FED1,+, FED2+, FED3+)	4.900,-
HEXAGON Spur Gear Bundle (ZAR1+ and ZAR5)	1,585.-
HEXAGON Graphic Package (DXF-Manager, HPGL-Manager, DXFPLOT)	741.-
HEXAGON Helical Spring Package (FED1+, FED2+, FED3+, FED5, FED6, FED7)	2,550.-
HEXAGON Tolerance Package (TOL1, TOL1CON, TOL2, TOLPASS)	945.-
HEXAGON Complete Package (All Programs of Engineering Package, Graphics Package, Tolerance Package, Helical Spring Package, TR1, FED8, FED9, FED10, ZAR4, GEO4, WN4, WN5, FED11,WN10, ZAR1W)	11,500.-

Quantity Discount for Individual Licenses

Licenses	2	3	4	5	6	7	8	9	>9
Discount %	25%	27.5%	30%	32.5%	35%	37.5%	40%	42.5%	45%

Network Floating License

Licenses	1	2	3	4	5	6	7..8	9..11	>11
Discount/Add.cost	-50%	-20%	0%	10%	15%	20%	25%	30%	35%

(Negative Discount means additional cost)

Language Version:
- **German and English :** all Programs
- **French**: FED1, FED1+, FED2, FED2+, FED3, FED3+, FED5, FED6, FED7, FED9, WL1+.
- **Italiano**: FED1, FED1+, FED2, FED2+, FED3, FED3+, FED5, FED6, FED7, FED9, DXFPLOT.
- **Swedish**: FED1, FED1+, FED2, FED2+, FED3, FED3+, FED5, FED6, FED7, DXFPLOT.
- **Portugues**: FED1, FED1+
- **Spanish**: FED1, FED1+

Updates:

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

Update Mechanical Engineering Package: 800 EUR, Update Complete Package: 1000 EUR

Maintenance contract for free updates: annual fee: 150 EUR + 40 EUR per program

Upgrades
For upgrades to network licenses or plus versions or software bundles, upgraded licenses are credited 75%.

Hexagon Software Network Licenses
Floating License in the time-sharing manner by integrated license manager
Individual licenses may not be installed in a network!

Conditions for delivery and payment
General packaging and postage costs are EUR 60, (EUR 25 inside Europe)
Delivery by Email (program packed, manual as pdf files): EUR 0.
Conditions of payment: bank transfer in advance with 2% discount, or by credit card (Master, Visa) net.

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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