KISSsoft AG - +41 55 254 20 50
Uetzikon 4 - +41 55 254 20 51
8634 Hombrechtikon - info@KISSsoft.AG
Switzerland - www.KISSsoft.AG

KISSsoft Tutorial:

Compression springs as specified in EN 13906

1 Starting KISSsoft

1.1 Starting the software

Once you have installed and activated KISSsoft either as a test or licensed version, follow these steps to call the KISSsoft system. Start the program by clicking "Start/Program Files/KISSsoft 08-2009/KISSsoft". This opens the following KISSsoft user interface:

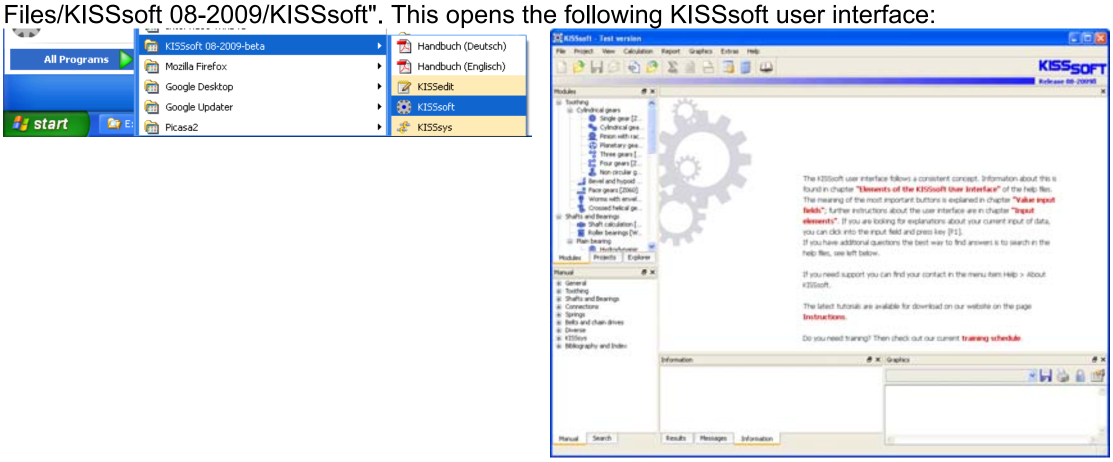

Figure 1.1 Starting KISSsoft, initial window

1.2 Selecting a calculation

In the Modules tree window, click the **"Modules"** tab to call the calculation for compression springs:

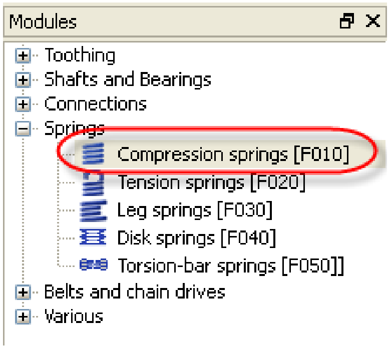

Figure 1.2 Selecting springs, compression springs

2 Analyzing Compression Springs

2.1 Task

Analyze a cold formed compression spring 4 x 32 x 120 made of spring steel. Search for this data:

- Spring rate R
- Shear stress τ_{k2} at F_2=300N
- Spring travel s_h

This tutorial then describes how you input the following data:

Wire diameter d	4.0 mm
Coil diameter D	40.0 mm
Effective coils n	12.5 mm
Spring length L_0	235.0 mm
Material	Wire C (DIN 17223-1), untreated
End of spring	Even
Tolerances	DIN 2095 quality standard 1

Table 2.1 **Geometry.**

Spring force F_1	150 n
Spring force F_2	300 n
Operating temperature	20.0 °C
Stress	dynamic
Support	fixed/ fixed

Table 2.2 Operating data

2.2 Inputting operating data

As shown below, you can input operating data directly in the input window. Here you can input either the forces or the travels.

Figure 2.1 Input window: "Operating data" group

The types of support are displayed in a help graphic that you open by clicking  next to the Support field. The support coefficient v is used to calculate buckling travel sk. If the required level of buckling safety is not achieved, the spring must be led, otherwise it will buckle.

If the spring must be led, the KISSsoft system issues a warning message when you perform the calculation to inform you of this fact.

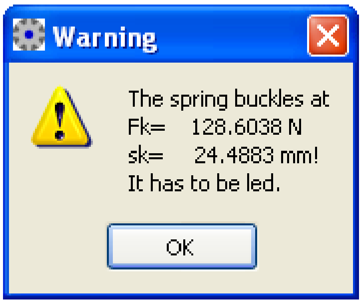

Figure 2.2 Warning: the spring will buckle and must be led

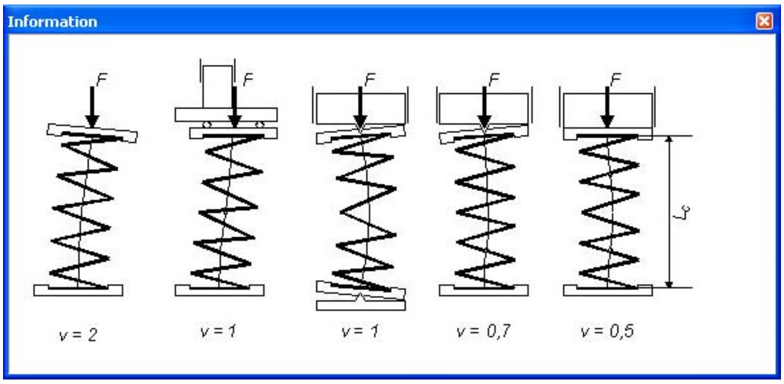

Figure 2.3 Types of support with the corresponding support coefficients

2.3 Inputting the geometry and selecting materials

The KISSsoft database includes a wide range of different compression springs all of which correspond to the specifications in DIN 2098, supplementary sheet 1. You can select the spring you require directly from this list. This example uses a spring selected from this list.

However, if the spring you require is not present, simply select **"Own input"** and input your own parameters for a spring. You will find more detailed information about this below.

To find a suitable spring, first click **"Update"**. The system now calculates and displays values that match your input, such as spring travel, spring forces. This helps you make the best possible choice.

Click the right-hand mouse button in the spring selection list to determine which values are to be displayed.

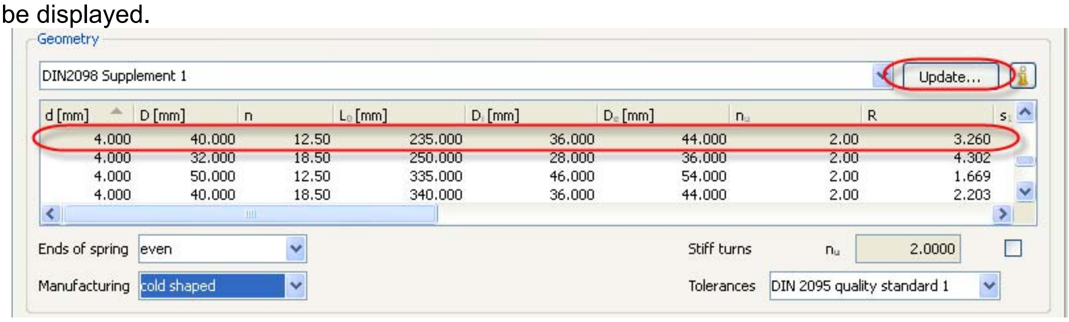

Figure 2.4 Input window, "Geometry" group - Selecting a spring

You can then either select or input the shape of the spring ends, the manufacturing method and the tolerances in the area below the table.

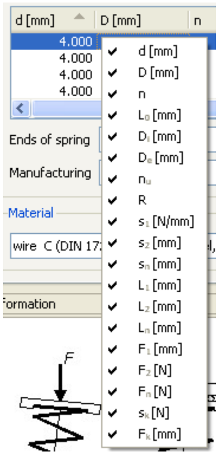

Figure 2.5 Clicking the right-hand mouse button to select which values are displayed

You can select the material either from a "drop-down list" or input your own values. If you set the flag in the **"shot-peened" checkbox**, the calculation will take into account the fact that the spring has been shot-peened.

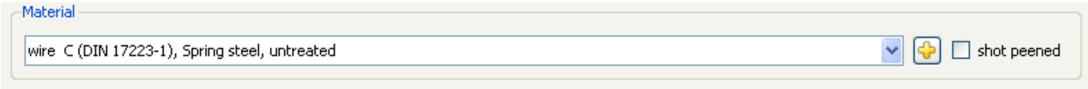

Figure 2.6 Selecting the material

2.4 Calculation

After you have input all the necessary data, either click  in the tool bar or press "F5" to calculate and then display the values.

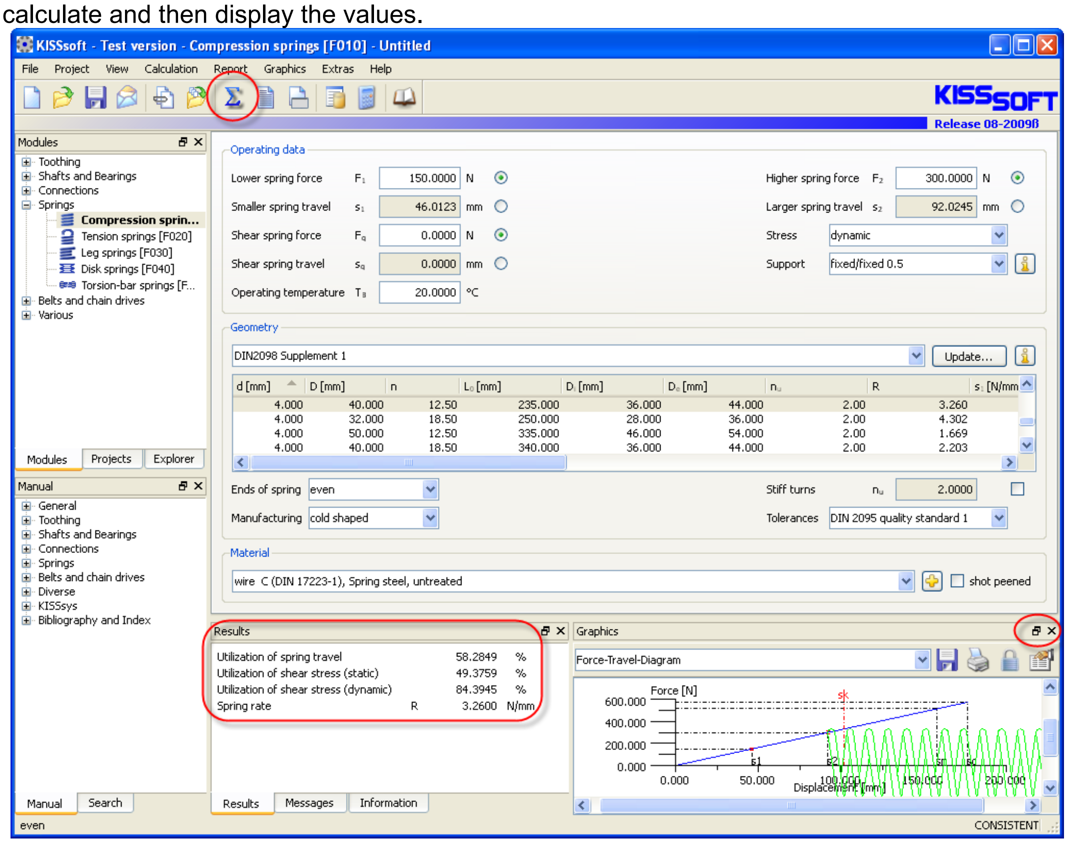

Figure 2.7 Analyzing a compression spring

The results show, among other things, the relevant spring rate. These values are displayed in the lower right-hand part of the graphic. The system provides a graphic for the force travel diagram and, for dynamic loads, a Goodman diagram (if a suitable diagram is not present, one will be approximated). To increase the scale of the graphic, click the enlarge button (right-hand marking).

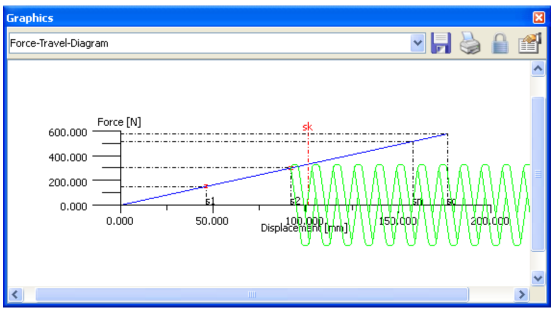

Figure 2.8 Force-travel diagram

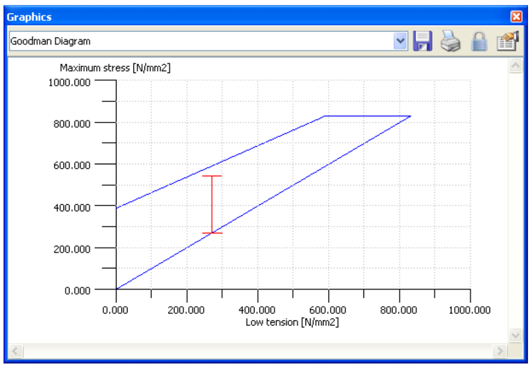

Figure 2.9 Goodman diagram

To get an overview of all the values, create a report by either clicking  or press "F6".

Compression springs [F010]

Calculation method: EN 13906-1 (2002)

INPUTS:

Spring geometry

Wire diameter (mm)	[d]	4.000
Tolerance analog to DIN 2076 C (mm)	[Tol_d]	0.025
Coil diameter (mm)	[D]	40.000
Inside diameter (mm)	[Di]	36.000
Outside diameter (mm)	[De]	44.000
Length of relaxes spring (mm)	[L0]	235.000
Effective coils	[n]	12.500
Stiff turns	[nu]	2.000
Total number of winds	[nt]	14.500
Ends of spring	surface flattened	
Bearings coefficient		0.500

Material

Material	wire C (DIN 17223-1)	
Cold shaped		
Not shot peened		
Shearing modulus at 20°C (N/mm²)	[G20]	81500.000
Tensile strength (N/mm²)	[Rm]	1000.00
1000.00		
Shearing modulus depending on temperature (1/°C)	[alphaE]	-0.00028

load

Lower spring force (N)	[F1]	150.000
Higher spring force (N)	[F2]	300.000
Operating temperature (°C)	[TB]	20.000
dynamic loading		

Results :

Spring rate (N/mm)	[R]	3.260
Maximum usable length (mm)	[Ln]	77.113
Maximum spring travel (mm)	[sn]	157.887
Sum of minimum distance	[Sa]	18.750
Shear stress at Fn (N/mm²)	[taun]	819.192
Force for maximum spring travel (N)	[Fn]	514.713
Theoretical force at length of block (N)	[Fcth]	575.838
Block length (mm)	[Lc]	58.363 (- 0.362)
Shear stress at block length (N/mm²)	[tauc]	916.475
Permissible shear stress at block length (N/mm²)	[tauc_zul]	967.000
Stress coefficient	[kappa]	1.135
Shear stress	[taukh]	270.994
Permissible way stress (N/mm²)	[taukh_zul]	321.103
The spring is safe for buckling in the used range		
Spring travel for buckling (mm)	[sk]	101.548
Spring force for buckling (N)	[Fk]	331.047
Shear modulus at service temperature (°C)	[G]	81500.000
Diameter increase (mm)	[DeltaD]	0.698
Eigen frequency (Hz)	[fe]	72.548
Mass (g)	[mass]	181.184

Load 1

Spring force (N)	[F1]	150.000
Spring travel (mm)	[s1]	46.012
Spring length (mm)	[L1]	188.988
Shear stress (N/mm²)	[tau1]	238.732
Adjusted shear stress (N/mm²)	[tau1k]	270.994

Load 2

Spring force (N)	[F2]	300.000

```
Spring travel (mm)                                  [s2]          92.025
Spring length (mm)                                  [L2]         142.975
Shear stress (N/mm²)                                [tau2]       477.465
Adjusted shear stress (N/mm²)                       [tau2k]      541.987


Utilization of shear stress (static)                               0.494
Utilization of shear stress (dynamic)                              0.844



Tolerances

According to DIN 2095 quality standard
                       1

Permissible deviation from
Coil diameter (mm)                                  [AD]           0.300
Lower spring force (N)                              [AF1]         11.700
Higher spring force (N)                             [AF2]         13.100
Spring length (mm)                                  [AL0]          3.160
Casing line (mm)                                    [e1]           7.050
Alignment (mm)                                      [e2]           0.660
```

2.5 Inputting your own spring data

If you want to analyze a special spring, or a spring that is not already present, click **"Own input"** and input your own values. Here, you can also use the spring rate (R=ΔF/Δs) to size the wire diameter and the effective coils.

Figure 2.10 Inputting spring geometry

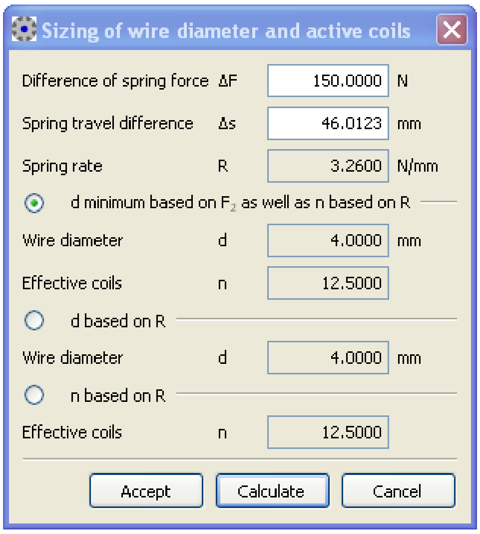

Figure 2.11 Sizing the wire diameter