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## KISSsoft Tutorial: Cylindrical Interference Fit

### 1 Starting KISSsoft

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:

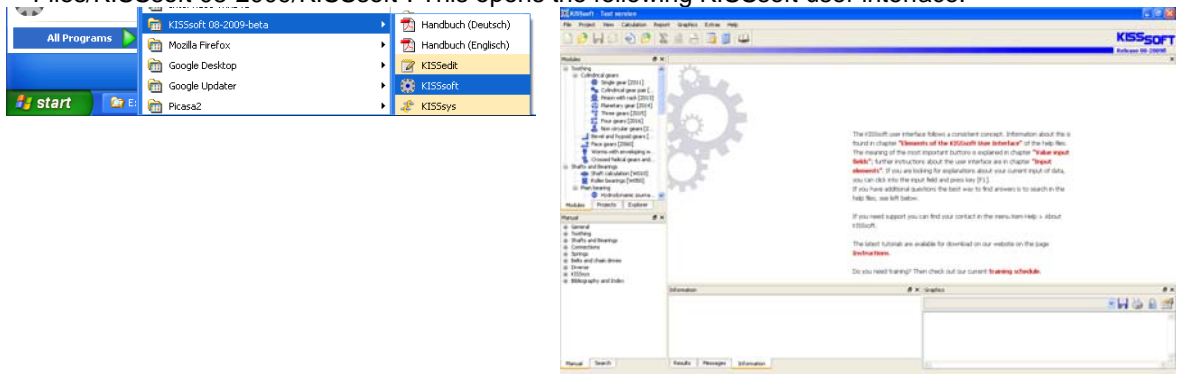


Figure 1.1 Starting KISSsoft, initial window.

#### 1.1 Selecting a calculation

In the Modules tree window, select the **"Modules"** tab to call the calculation for cylindrical interference fit:

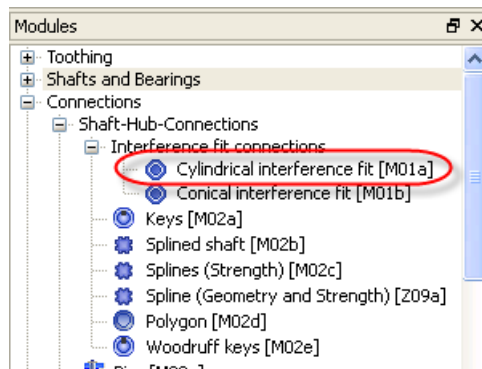


Figure 1.2 Selecting the "Cylindrical interference fit" calculation module under Shaft-Hub-Connections

## 2 Calculating a cylindrical interference fit

### 2.1 Task

To size a cylindrical interference fit using the following data to ensure no slippage occurs.


Joint diameter	60 mm	Coefficient of friction	0.12
Length of interference fit	50 mm	Operating temperature	20 °C
Outer diameter, hub	90 mm	Application factor	1.25
Bore shaft	10 mm	Material shaft	34CrNiMo6
Nominal torque	400 Nm	Material hub	C60
Axial force	200N	Surface quality shaft	N6
Speed	10'000 rpm	Surface quality hub	N6

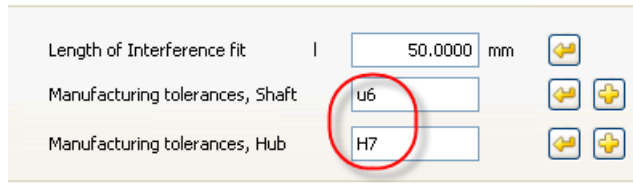
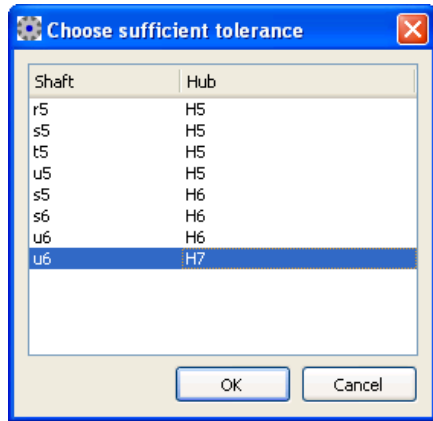
Enter this data as follows:

Figure 2.1 Input window: - Inputting the known data

The first step is to define a suitable tolerance pair.

### 2.2 Sizing a tolerance pair


Click  to the right of the entries for manufacturing tolerances, see the marking in **Figure 2.1**, to open a list with possible tolerance pairs. You can select any of these tolerance pairs, for example, the one that is most cost-effective to manufacture. Then click **"OK"** to transfer your selection to the main screen.

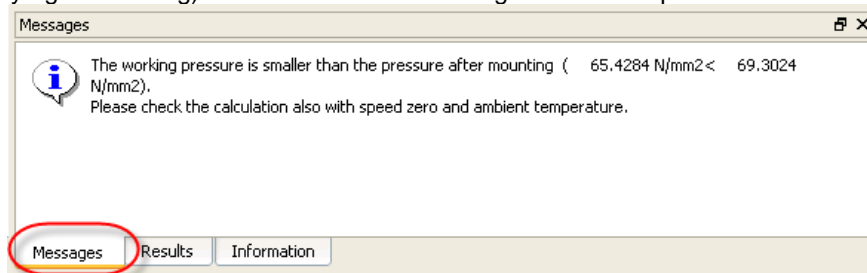


**Figure 2.2** Selecting and transferring a tolerance pair

Alternatively, if you already know the tolerances of the shaft and hub, you can also input these values directly. This process is described in section 2.4.4 "Defining your own tolerances". You now have all the data required to verify an interference fit.

### 2.3 Running the analysis and report

Click the  icon in the Tool bar (see upper marking in **Figure 2.4**) or press "F5" to run the calculation. The most important results are displayed in the **"Results"** window (here, for example, safety against sliding). KISSsoft issues a message in the example shown here:

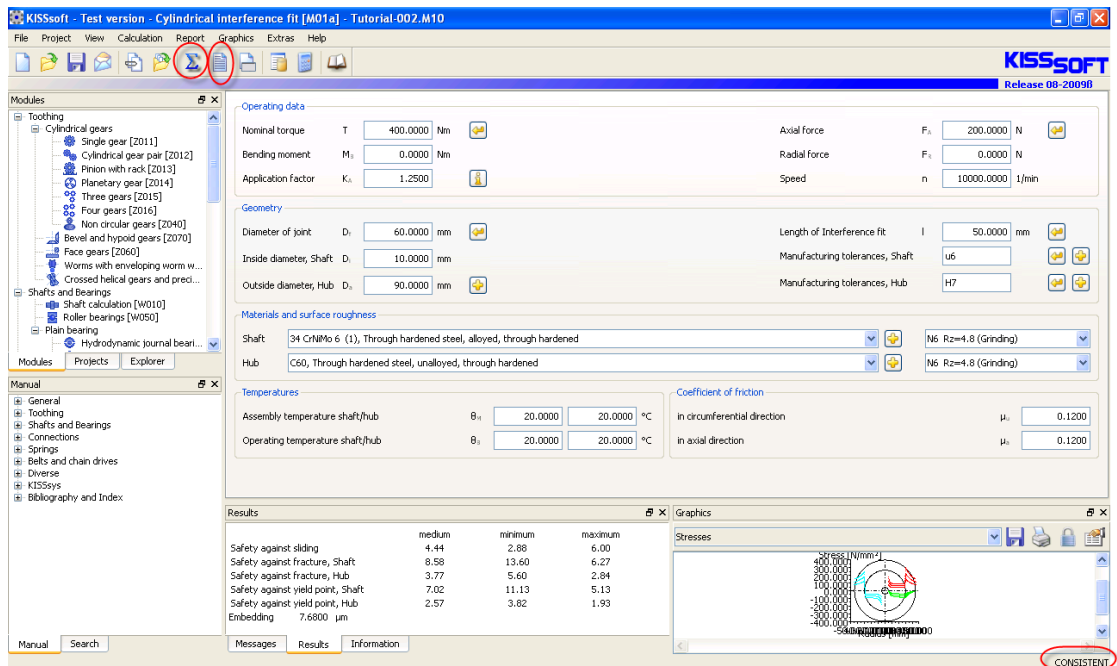


**Figure 2.3** KISSsoft information

The forces created by operating speed mean that the pressure in the connection is higher during assembly than during operation. For this reason, you should run another calculation with speed set to zero to check the yield point during assembly. Click **"OK"** to close the message.

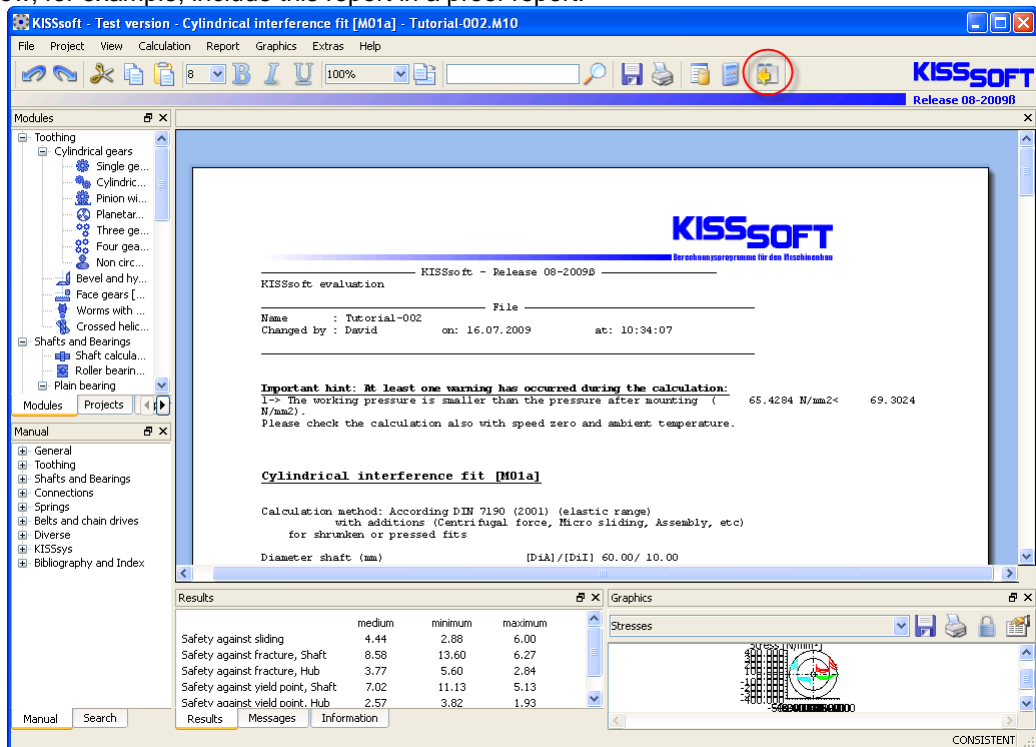
Note the status bar shows "Results are consistent" (see marking on the lower-right hand side in **Figure 2.4**). This shows that the input data matches the displayed results (for example, if you now change the nominal torque, the message "INCONSISTENT" appears until you click **"Σ"** again to rerun the calculation).

The method used to calculate a cylindrical interference fit is applied as specified by DIN 7190, valid for the group.



**Figure 2.4** Running the calculation - calling the report

Either click "**Generate report**", (see the marking to the right of "**Σ**" in **Figure 2.4**) or press "F6" to create the analysis report which lists all the parameters used in the calculation. You can now, for example, include this report in a proof report.



**Figure 2.5** Report viewer

The report also contains other results, for example **"Details about hub and shaft temperature during assembly"** or the **"Limiting torque"** to avoid micro-sliding.

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Service / Mounting / Remounting

Transverse interference fit:
Mounting clearance (mm) [PsTh] 0.060
Temperature difference for mounting:
Shaft at 20°C(68°F), Temperature hub (°C) [ThA] 260.58
Shaft at -150°C(-278°F), temperature hub (°C) [ThA] 134.93
(calculated using coefficient of thermal expansion of
shaft according to DIN 7190 (10^-6/K) [alpha] 8.50

Longitudinal pressure fit:
Assembly temperature shaft (°C) [ThM] 20.00
Assembly temperature hub (°C) [ThM] 20.00
Coefficient. of friction (Longitudinal)
[mye=mya*1.3] 0.16
Press on (force) (kN) [Fpress] 101.89 ( 68.08..135.71)
Coefficient. of friction (Longitudinal)
[myll=mya*1.6] 0.19
Press out (force) (kN) [Fpress] 125.41 ( 83.79..167.03)

Note:
Micro sliding can occur in Interference fit!
=> Risk of contact corrosion.
Coefficient. of friction [my] 0.19
Max. torque to avoid microsliding (Nm) [Tlimit] 561.60 (364.18..759.02)

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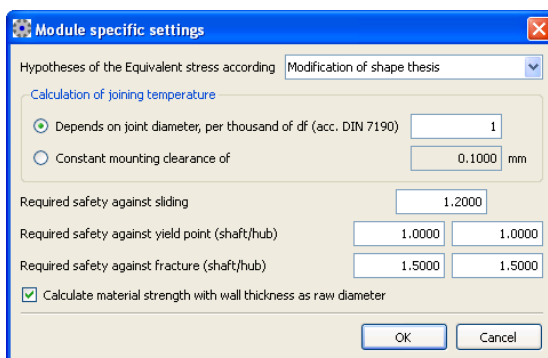
**Figure 2.6** Section of the report showing details about assembly and the limiting torque to prevent micro-sliding

Click the **Figure 2.5** marked icon  to return to the input window.

## 2.4 Further analysis options and settings

### 2.4.1 Settings

Select menu item **"Calculation"-> "Settings"**, or click the appropriate button in the tool bar to open this menu. The values shown here influence the calculation and must therefore be checked carefully.



**Figure 2.7** Module-specific settings



Select the hypothesis for the stress invariant

Required safety factors, especially against sliding. These values are not included in the calculation run. The system issues a warning if these values are not reached during the analysis process.

Shows how the part strength is determined from test strength analysis (size influence)

### 2.4.2 Calculate the maximum permissible nominal torque

Now calculate the maximum permissible torque such that the minimum safety against sliding is 1.20. All other parameters remain as defined above.

To do this, click the "Sizing" button  to the right of the input field for nominal torque (see marking 1 in **Figure 2.8**). The software then determines the maximum nominal torque, in this case as 959.68 Nm. If you then recalculate the shaft hub connection with this load ( or

press F5), the minimum Safety against sliding will be equal to the required minimum safety of 1.2 (see marking 3 below in Figure 2.8):

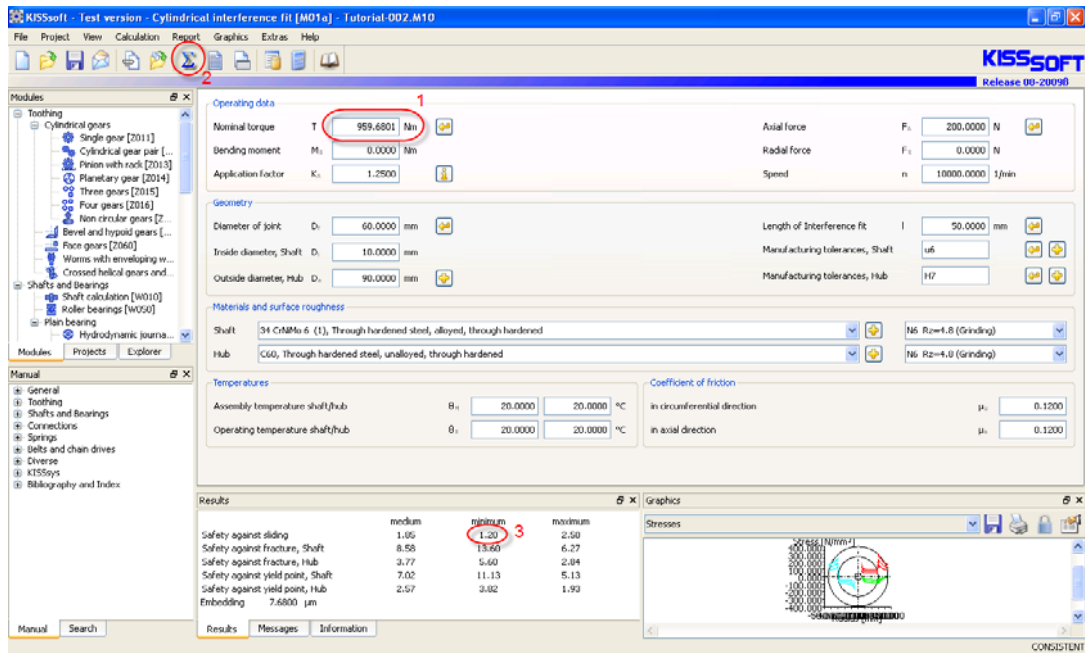




Figure 2.8 Sizing to maximum nominal torque

### 2.4.3 Hub with varying outer diameters

Click the "Plus button"  to the right of the input for the hub outer diameter to allow extended input for hub geometry. Click the "Plus button"  to define a hub with a variable outer diameter. This hub in this example has 90 mm outer diameter for 25 mm length and 100 mm outer diameter for 25 mm length:

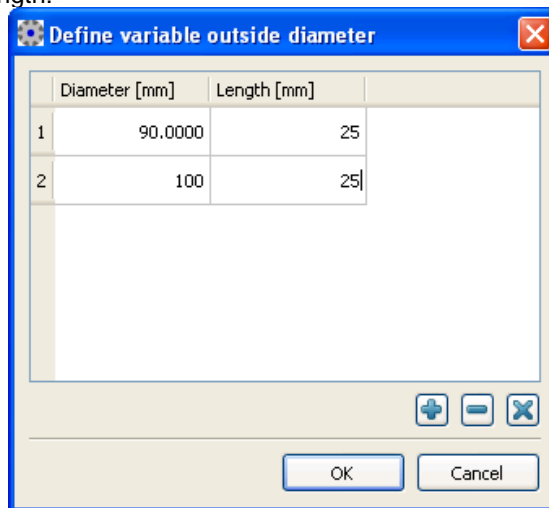



Figure 2.9 Defining a hub with variable outer diameter

You can only input this data if the shaft does not have a hole. Otherwise the following error message appears.



Figure 2.10 Error message

## 2.4.4 Defining your own tolerances

Click the "Plus button"  to the right of the input field for tolerances to input your own tolerance values. To do this, set the flag in the "Checkbox" for "Own tolerances" and input the value you require:

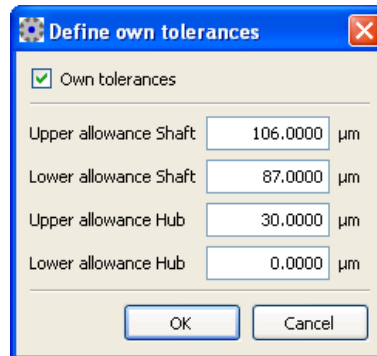


Figure 2.11 Defining your own tolerances

## 2.4.5 Influence of temperature

The reference temperature is 20°C.

Note: The maximum operating temperature is 700°C.

If you input a different operating temperature in the main screen, the interference pressure changes as a function of the difference in the coefficient of thermal expansion of the shaft/hub material. You can modify this by setting the material to "Own input" in the material properties screen.

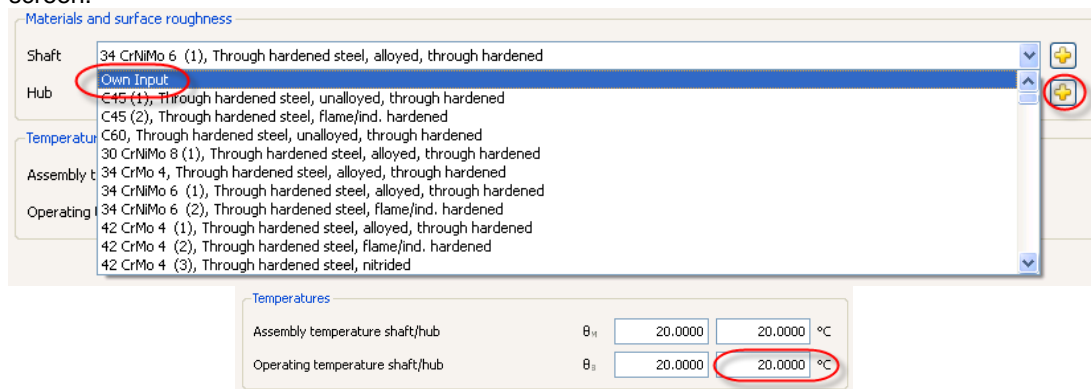



Figure 2.12 Inputting your own material (in particular coefficient of thermal expansion) and operating temperature

Click  (upper right-hand marking in Figure 2.12) to the right of the material selection list to modify the material properties:

Property	Value	Unit
Label	34 CrNiMo 6 (1)	
Material type	Heat treatable steel	
Type of treatment	alloyed/through hardened	
Tensile strength ( $R_m$ )	1100.0000	N/mm <sup>2</sup>
Yield point ( $R_p$ )	900.0000	N/mm <sup>2</sup>
Youngs modulus ( $E$ )	206000.0000	N/mm <sup>2</sup>
Poisson's ratio ( $\nu$ )	0.3000	
Density ( $\rho$ )	7830.0000	kg/m <sup>3</sup>
Warmth elongation coefficient ( $\alpha$ )	11.5000	10 <sup>-6</sup> /°C

**Figure 2.13** Defining a specific material

The data you input for this new material only applies to this calculation. After you save this file, this data is no longer available to any other calculation. If you want other calculations to be able to use the data for this new material, you must store this information in the material database.

#### 2.4.6 Additional loads

In the "**Radial force**" and "**Bending moment**" input fields you can also input additional radial forces and bending moments (for example, those that result from the tooth forces in a gear). The software then also calculates additional stress. To ensure no gaps occur between the hub and the shaft, the additional pressure must be less than the minimum interference pressure. If not, an error message appears and the calculation is not performed.