1 Starting KISSsoft

1.1 Starting the software

Start KISSsoft using „Start/Programme/KISSsoft 10-2008/KISSsoft“. The following window will appear:

Figure 1.1-1: Start KISSsoft, KISSsoft main window.

1.2 Select Calculation

Using the Module tree window Tab “Modules”, select the interference fit calculation:

Figure 1.2-1: Selecting cylindrical interference fit calculation.
2 Analysis of a cylindrical interference fit

2.1 Task description

A cylindrical interference fit with the following data should be dimensioned such that no slippage occurs. This data is to be entered as shown:

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint diameter</td>
<td>60mm</td>
<td>Coefficient of friction</td>
<td>0.12</td>
</tr>
<tr>
<td>Length</td>
<td>50m</td>
<td>Working temperature</td>
<td>20°C</td>
</tr>
<tr>
<td>Outer diameter, hub</td>
<td>90mm</td>
<td>Application factor</td>
<td>1.25</td>
</tr>
<tr>
<td>Inner diameter, shaft</td>
<td>10mm</td>
<td>Material shaft</td>
<td>34CrNiMo6</td>
</tr>
<tr>
<td>Nominal torque</td>
<td>400Nm</td>
<td>Material hub</td>
<td>C60</td>
</tr>
<tr>
<td>Axial force</td>
<td>200N</td>
<td>Surface quality shaft</td>
<td>N6</td>
</tr>
<tr>
<td>Speed</td>
<td>10’000Rpm</td>
<td>Surface quality hub</td>
<td>N6</td>
</tr>
</tbody>
</table>

In a first step, a suitable tolerance pair for the outer diameter of the shaft and the inner diameter of the hub is to be calculated.

2.2 Definition of suitable tolerance pair

Pressing the “Size button” right to the field for the tolerances, see marking in Figure 2.1-1, a list with suitable tolerances is shown. Now, a tolerance can be chosen according to various criteria, e.g. manufacturing costs. By pressing “Ok”, the selection is transferred into the main window:

Figure 2.1-1: Input window - entering the basic data.
Alternatively, if the tolerances are known, they can be entered directly. In chapter 2.4.4 the definition of own tolerances is described. Now, all data is available to calculate the safety against slippage.

2.3 Execution of analysis and reporting

Pressing in the Tool bar the icon “Σ” (or the button F5) in the main window it will start the analysis (see left marking in Figure 2.3-1) and the resulting safety factors (e.g. against slippage) will show in the lower section of the main window. Note the status bar shows “Results are consistent” (see right marking in Figure 2.3-1). This shows that the data entered and the results shown are corresponding (if now e.g. the nominal torque is changed, the flag will disappear until the analysis is executed again).

The analysis method of the cylindrical interference fit is according to the standard DIN 7190, valid for the elastic range of the materials.

Figure 2.3-1: Starting the analysis and showing consistent results.
In this example KISSsoft gives us a message:

![Image](KISSsoft_information.png)

**Figure 2.3-2: KISSsoft information.**

Due to the forces created by the operating speed, the pressure in the connection is higher at assembly than during operation. Therefore another calculation for the case of no speed should be run, in order to check the yield strength in assembly state.

The message can be quit with „Ok“.

Using in the Tool bar the icon to the right of “Σ” (or F6) a report containing all input data, analysis parameters, and results is written. This report can be used for various purposes e.g. in a proof report.

![Image](Report_generated.png)

**Figure 2.3-3: Report generated.**

In the report, further results – like assembly temperatures or limiting torque to avoid micro-slippage (in order to avoid friction corrosion) – are shown:
Service / Mounting / Remounting

Transverse-interference-fit:
Mounting clearence (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] 0.13
Press on (force) (kN) [Fpress] 84.91 (56.73..113.09)
Coefficient. of friction (Longitudinal) [myl=mya*1.6] 0.16
Press out (force) (kN) [Fpress] 104.51 (69.82..139.19)

Notice:
Micro sliding can occur in Interference fit!
=> Risk of contact corrosion.
Coefficient. of friction [my] 0.16
Max. torque to avoid Micro sliding (Nm) [Tlimit] 468.00 (303.48..632.52)

Figure 2.3-4: Section in the protocol with information on assembly and limiting torque against micro-gliding.

With the marked icon (see in Figure 2.3-3: Report generated) you will get back to the main window.

2.4 Further analysis options and settings

2.4.1 Settings

By using “Calculation” -> “Settings” or the icon in the tool bar, the following window shows. The parameters defined here influence the analysis and are to be checked.

Hypothesis for stress invariant
Information on how the part strength is calculated from the material strength (influence of size)
Required safety factors, including safety against sliding, here set to 1.2. Note that these values are not used in the analysis, however, a warning will be given if these values are not reached.

Figure 2.4-1: Module specific settings.

2.4.2 Calculation of maximum permissible nominal torque

Now, the maximum permissible nominal torque is to be calculated such that the minimal safety against sliding is 1.20. All other parameters are to remain as defined above.
For this, the “Size Button” next to the field for the nominal torque should be pressed, see upper marking in Figure 2.4-2, and the program will then calculate the maximum permissible nominal torque to be 959.68Nm. If the interference fit is re-calculated using this value (press “Calculate F5”, left marking in Figure 2.4-2), the minimal safety against slippage will be equal to the required safety factor of 1.2 (see right marking in Figure 2.4-2).
2.4.3 Hub with varying outer diameter

Using the “Plus button” right to the field for the interference fit length, an option for the definition of the hub geometry is available. Press the “Plus button” allows the user to define several sections of the hub with different outer diameters. Here shown for a hub with 90 mm outer diameter for 25 mm and 100 mm outer diameter for another 25 mm length:

Note if the shaft has a hole the input will not available. Following massage is displayed.
2.4.4 Defining your own tolerances
Using the “Plus button” next to the field for the tolerances, specific tolerances can be set. Setting the flag in the “Checkbox” „Own tolerances“ for this:

2.4.5 Influence of temperature
The reference temperature is 20°C.
Note that the maximum service temperature is 700°C.
If the service temperature is changed, the interference pressure changes as a function of the difference in the coefficient of thermal expansion of the materials. The material properties can be modified by choosing “Own input”.

Pressing the „Plus button“ (right marking of the Figure 2.4-6), own material properties may be defined:
The data given for this new material is available only in this calculation file after having saved it. If the material is to be available in another interference fit calculation as well, the material has to be defined using the materials database.

### 2.4.6 Additional loads

In addition to the loads used in this example, radial force and bending moment acting on the hub (e.g. tooth forces from a gear) can be defined, see fields “Radial force“ and „Bending moment“. These external loads result in an additional pressure. In order to avoid a gap between the hub and the shaft, this pressure has to be lower than the minimum interference pressure. If this condition is not satisfied, an error message is issued and the analysis is not executed.