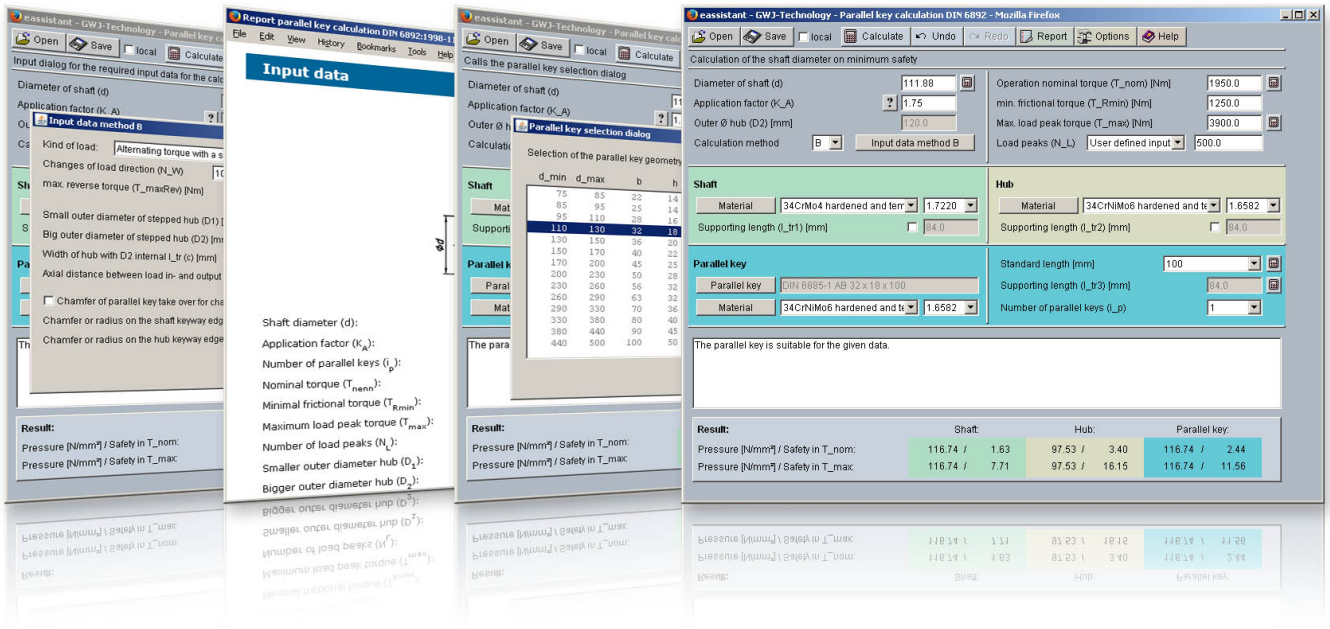
Calculation Example

Parallel Keys According to DIN 6892



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0.1 Calculation Example: Parallel Key According to DIN 6892

0.1.1 Start the Calculation Module

Please login with your username and your password. To start the calculation module for parallel keys, please click the menu item 'Connections' on the left side and then select 'Parallel keys'.

0.1.2 Calculation Example

A strength calculation for the following shaft-hub-connection is required (see also DIN 6892, Example E.2). Enter the following values into the input fields:

Shaft diameter = 60 mm
Application factor = 1.75
Outer diameter hub D_2 = 120 mm
Calculation method = B
Operation nominal torque M_{tnom} = 1950 Nm
Min. frictional torque M_{tRmin} = 1250 Nm
Max. load peak torque M_{tmax} = 3900 Nm
Load peaks N_L = 500
Material shaft = C45 hardened and tempered
Material hub = 34CrNiMo6 hardened and tempered
Parallel key = DIN 6885.1 AB 18 x 11 x 100
Material parallel key = 34CrNiMo6 hardened and tempered
Standard length parallel key = 100 mm
Number of parallel keys = 1

Inputs Method B:

Kind of load = Alternating torque with a slow torque increase
Changes of load direction = 10^6
Max. reverse torque $M_{tmaxRev}$ = 3900 Nm
Small outer diameter D_1 = 120 mm
Large outer diameter D_2 = 120 mm
Width of hub within l_{tr} = 91 mm
Axial distance a_0 = 45.5 mm
Chamfer/radius on shaft keyway edge s_1 = 1.0 mm
Chamfer/radius on shaft keyway edge s_2 = 1.0 mm

0.1.3 Start the Calculation

Please start to enter the values into the input field. All important calculation results will be calculated during every input and will be displayed in the result panel. A recalculation occurs after every data input.

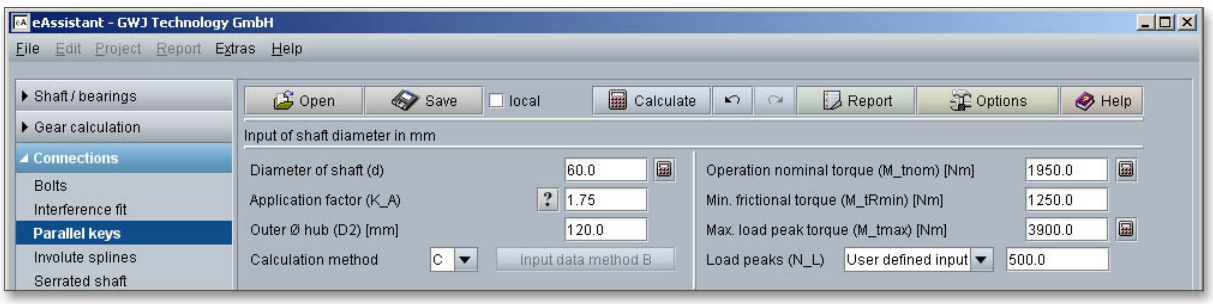

Figure 1: Input of the values

During the input of the values it can happen that the results will be marked in red. Nevertheless, please continue to input the data as usual. For the load peaks N_L, please select the entry 'User defined input' from the listbox. Enter the the value 500 into the adjacent input field.

0.1.4 Calculation Method B

The direction of the torque is reversed and a rough calculation according to Method C is not possible. It is recommended to use the calculation method B. Select the calculation method B from the listbox and click the button 'Input data method B'.

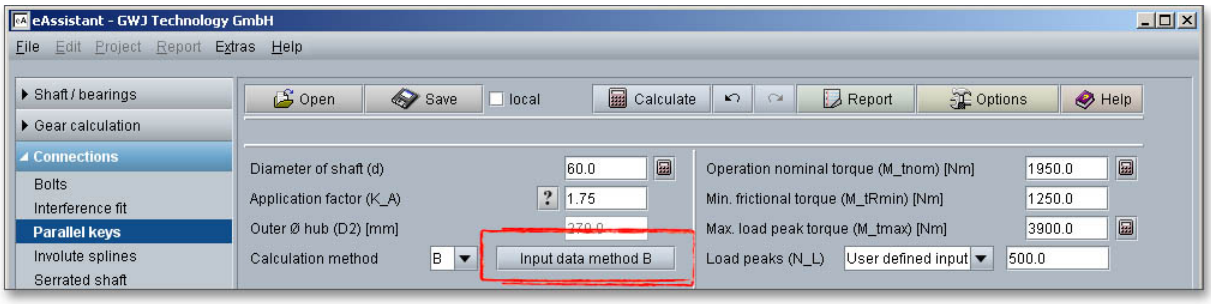

Figure 2: Calculation method B

Clicking this button opens the window 'Input data method B' and allows you to enter the other input values.

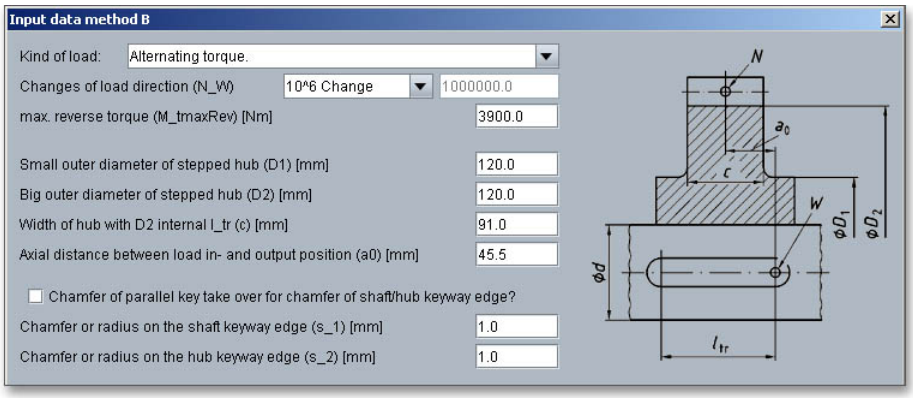

Figure 3: Calculation method B

Hinweis: If, at a later time, you need to change certain values, then click the button 'Input data method B' and the input mask will open again.

Input Values for Shaft and Hub

Specify the material for the shaft and the hub. The material for the shaft is C45 hardened and tempered. The required material for the hub is 34CrNiMo6 hardened and tempered. Both materials can be selected from the listbox.

Figure 4: Material selection for shaft and hub

Select the material either from the listbox or click the button 'Material' to open the material database. The database allows you to choose the material. You also get detailed information on the kind of material, hardness factor f_H, yield point as well as support factor f_S.

Input Values for Parallel Key

The parallel key selection according to DIN 6885 sheet 1 to 3 makes it easier to choose the required parallel key. You can also select the geometry and size of the parallel key. The database also provides the standard lengths of the parallel keys. The dimensions of the parallel key are as follows: DIN 6885.1 AB 18 x 11 x 100.

Standard Length

In order to define the standard length of the parallel key, select the value '100' from the listbox.

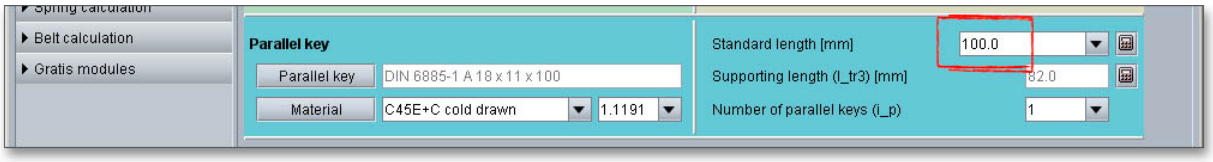

Figure 5: Standard length

Selection of the Parallel Key Geometry

Click on the button 'Parallel key' to select the shape of the parallel key.

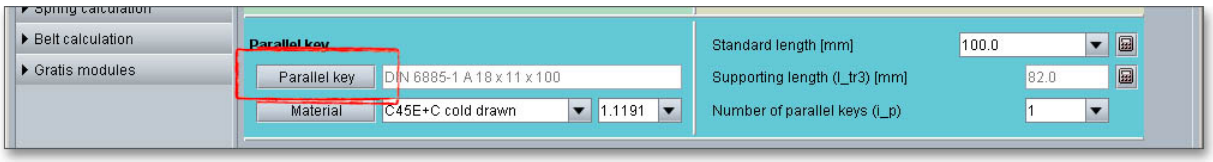

Figure 6: Button 'Parallel key'

The geometry selection shows the suitable parallel key. Select the parallel key geometry DIN 6885 sheet 1-8/1968 as well the shape AB from the listbox. Click the button 'OK' to confirm the values.

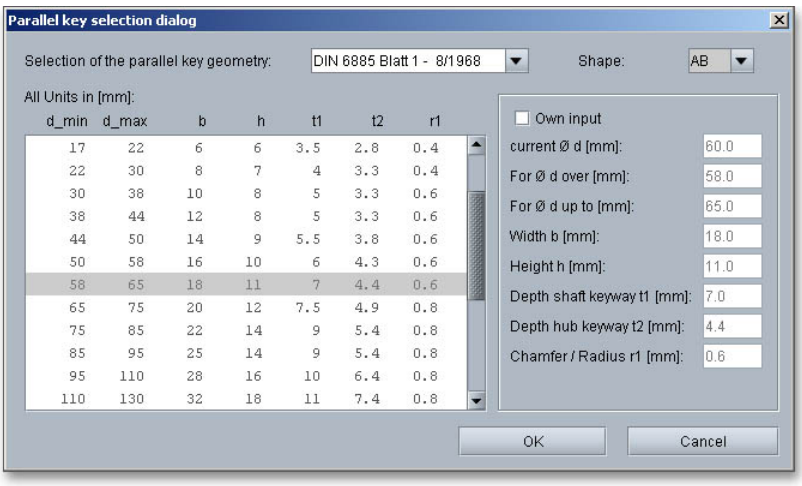

Figure 7: Selection dialog for the parallel key

Selection of Material

Select the material 34CrNiMo6 hardened and tempered from the listbox. If you need further information on the material, click the button 'Material' to open the material database.

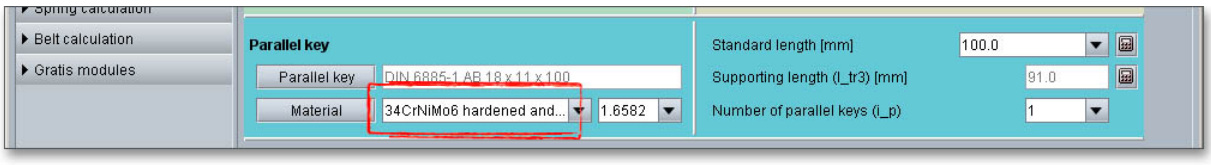

Figure 8: Material for parallel key

Supporting Length and Number of Parallel Keys

The supporting length l_{tr} is determined automatically from the selected standard length. You can use the listbox to select the number of parallel keys. For our calculation example we specify one parallel key.

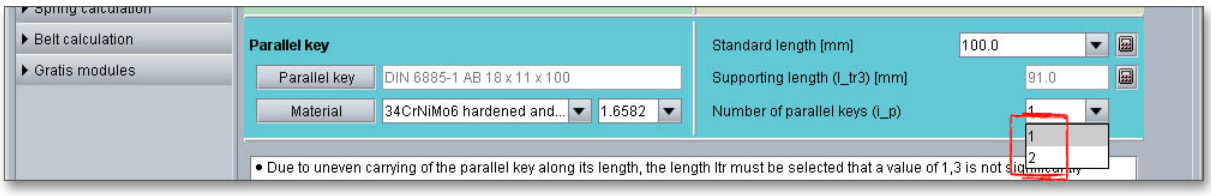

Figure 9: Supporting length and number of parallel key

0.1.5 Calculation Results

All important calculation results, such as the safeties for the operation load or at the maximum load for all three components (shaft, hub and parallel key) or the equivalent pressure will be calculated during every input and will be displayed in the result panel. A recalculation occurs after every data input. Any changes that are made to the user interface take effect immediately. You will get the results for the equivalent pressure and for the pressure at load peak as well as the safety at operation load and the safety at peak load.

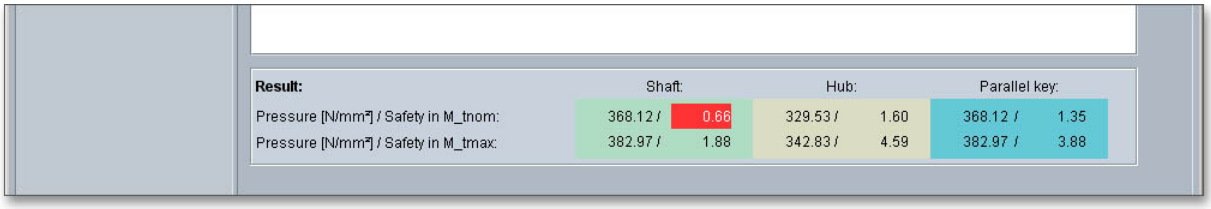

Figure 10: Calculation results

In our calculation example the safeties for the shaft, the hub and the parallel key are marked red. That means the minimum safeties are not fulfilled. In addition, you get also an appropriate message in the message window. The parallel key is not suitable for our calculation example.

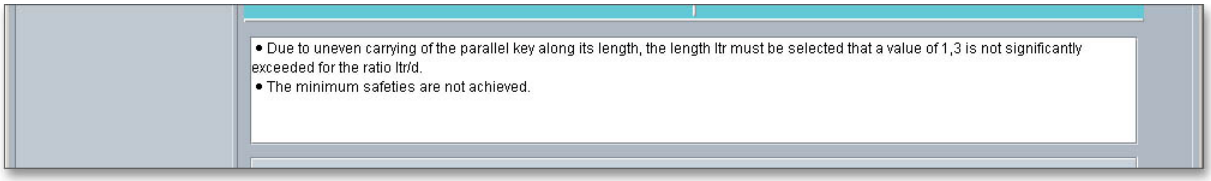

Figure 11: Message window

Minimum Safety: Dimensioning of the Shaft Diameter

Use the automatic dimensioning function (calculator button) in order to determine the shaft diameter. With just one click, the program automatically determines the shaft diameter so that the required minimum safety of 1.2 will be fulfilled. To do so, please click the calculator button next to the input field of the shaft diameter.

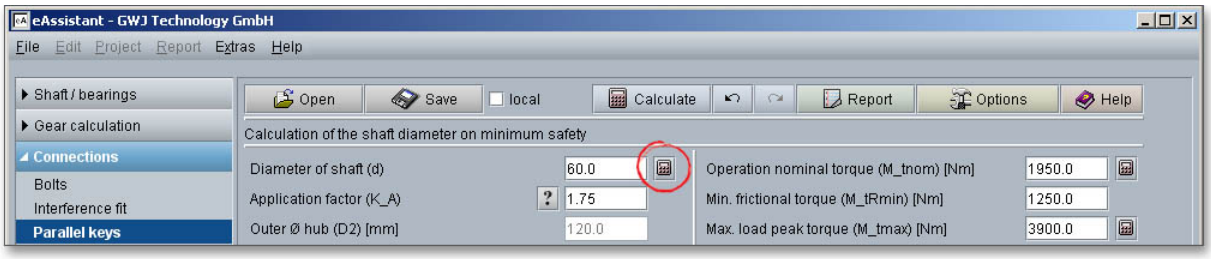

Figure 12: Dimensioning button for the shaft diameter

Now the new shaft diameter is determined.

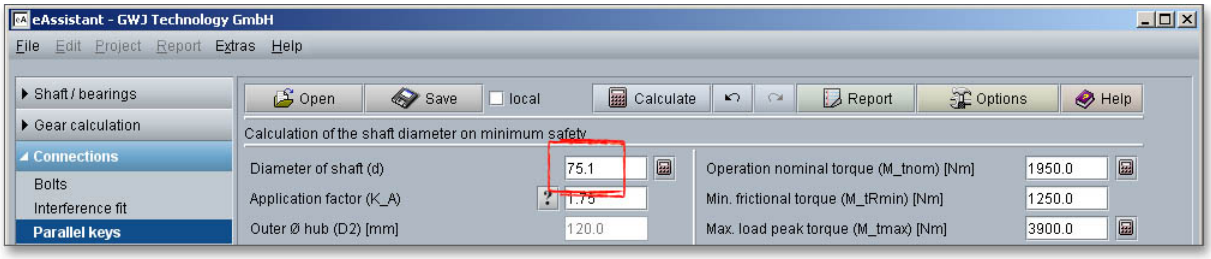

Figure 13: New shaft diameter

The shaft diameter is now $d = 75.1$ mm. With this diameter the minimum safety of 1.2 is achieved and the parallel key is suitable for this application. The safety can even be increased by selecting another material.

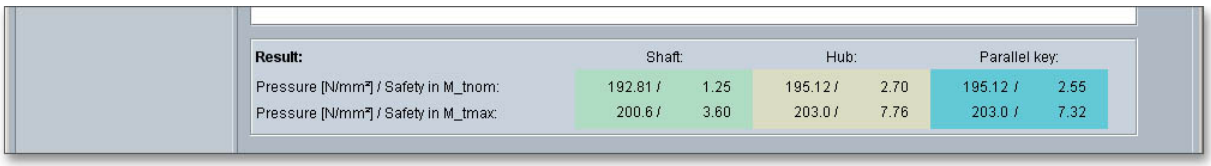

Figure 14: Calculation result

Due to the new dimensioning, the shaft diameter is now larger. A new size of the parallel key was determined automatically. Click the button 'Parallel key' and the larger parallel key is displayed automatically.

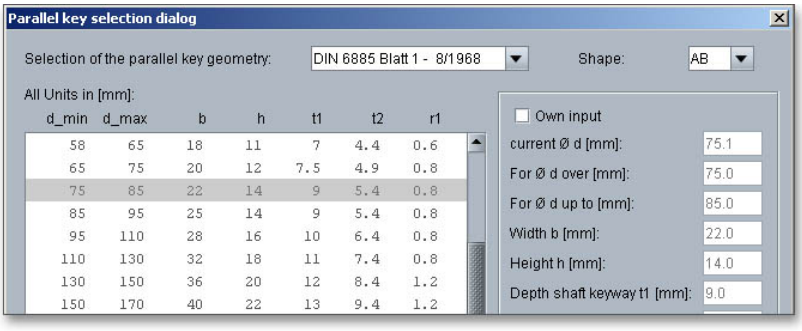

Figure 15: New parallel key

0.1.6 Documentation: Calculation Report

Use the button 'Report' to generate the calculation report very fast. This report contains the calculation method, all input values as well as the detailed results.

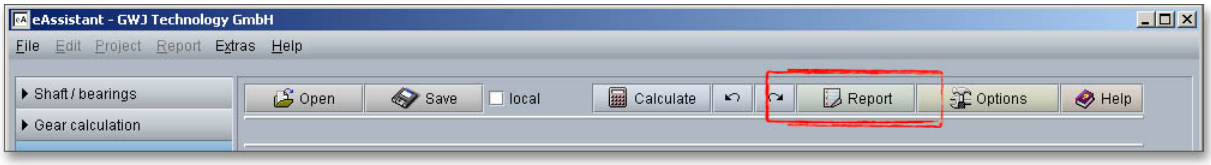

Figure 16: Button 'Report'

The calculation report contains a table of contents. You can navigate through the report via the table of contents that provides links to the input values, results and figures. The report is available in HTML and PDF format. Calculation reports, saved in HTML format, can be opened in a web browser or in Word for Windows.

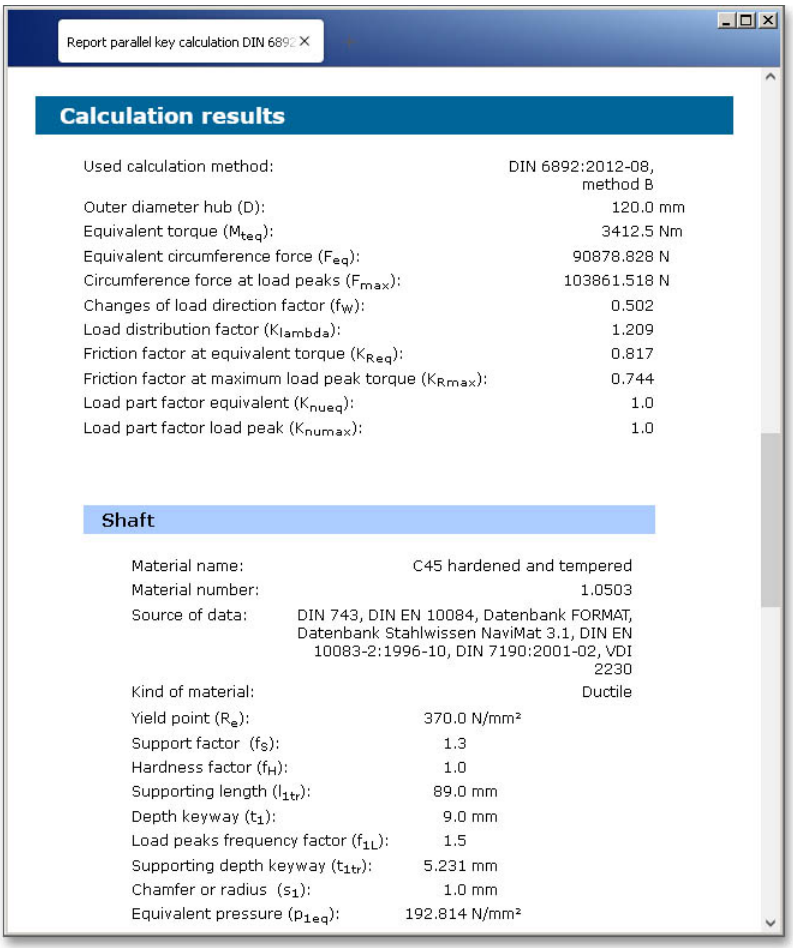

Figure 17: Calculation report

You may also print or save the calculation report:

- To save the report in the HTML format, please select 'File' ⇒ 'Save as' from your browser menu bar. Select the file type 'Webpage complete', then just click on the button 'Save'.
- If you click on the symbol 'Print', then you can print the report very easily.
- If you click on the symbol 'PDF', then the report appears in the PDF format. If you right-click on the PDF symbol, you should see the 'Save Target As' option. Click on that option and you will see the dialog box for saving the report.

0.1.7 How to Save the Calculation

When the calculation is finished, it is easy to save the calculation. You can save your calculation either to the eAssistant server or to your computer. Click on the button 'Save'.

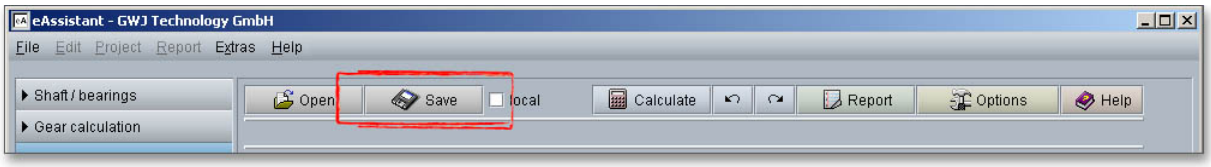

Figure 18: Button 'Save'

Before you can save the calculation to your computer, you need to activate the checkbox 'Local' in the calculation module. A standard Windows dialog for saving files will appear. Now you will be able to save the calculation to your computer.

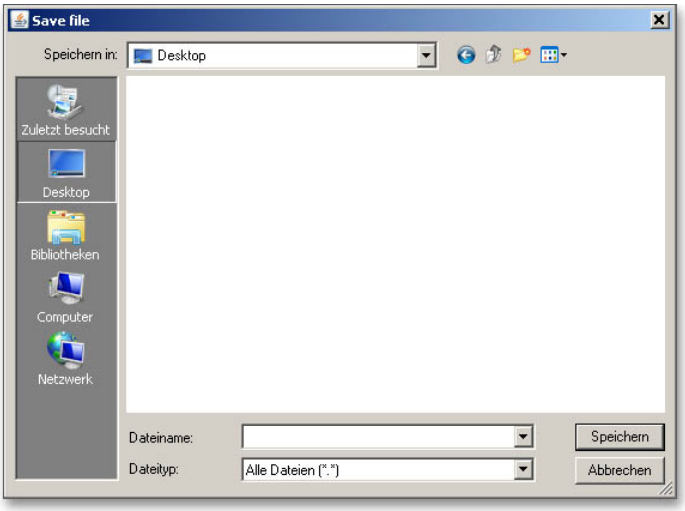

Figure 19: Windows dialog for saving the file

In case you do not activate the option in order to save your files locally, then a new window is opened and you can save the calculation to the eAssistant server. Please enter a name into the input field 'Filename' and click on the button 'Save'.

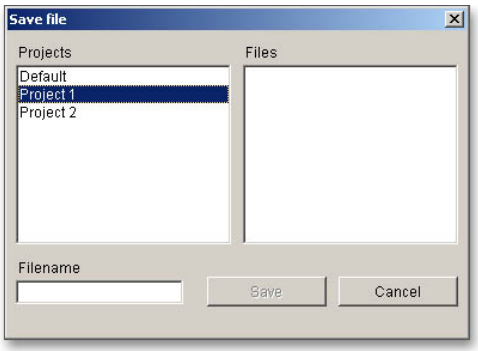

Figure 20: Save the calculation

Our manual is improved continually. Of course we are always interested in your opinion, so we would like to know what you think. We appreciate your feedback and we are looking for ideas, suggestions or criticism. If you have anything to say or if you have any questions, please let us know by phone *+49 (0) 531 129 399-0* or email *eAssistant@gwj.de*.