

KISSsys 2020 – Instruction 0021

KISSsys default load spectrum calculation

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1 Document information

1.1 Document change record

| Revision | Date | Author | Comments |
|----------|------------|--------|---|
| 0 | 10.6.2014 | HD | Original document |
| 1 | 31.3.2015 | CY | Changes to adapt 2015 version, where own input is not available |
| 2 | 11.04.2016 | TP | Restructure of the buttons on the interface |
| 3 | 15.08.2019 | FK | Updating with Rel. 2019 |
| 4 | 08.06.2020 | FK | Updating with Rel. 2020 |

2 Introduction

2.1 Load spectrum definition in KISSsoft database

Note that this function works for KISSsys models where you have simple kinematics. Models with **power splits** and **different power paths** (transmission gearboxes) can be handled better by using the [load spectrum template](#) (see documentation on the KISSsoft homepage).

3 Using the KISSsys functions

3.1 Select a load spectrum

Once some calculations are in the KISSsys file, you can select a load spectrum from using the button as shown below (general button since 2016, the other one is for the load spectrum template calculation).

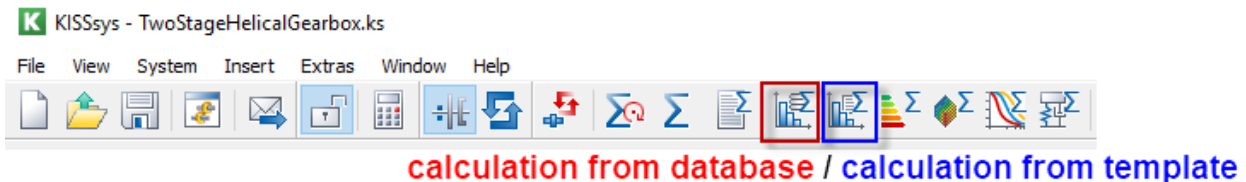


Figure 1. Function to select a load spectrum either from database or template

Then, a dialog will appear where you can select the load spectrum from a list. The following options are possible:

- 1) Use single load (nominal load condition)
- 2) Select a predefined load spectrum from the database.

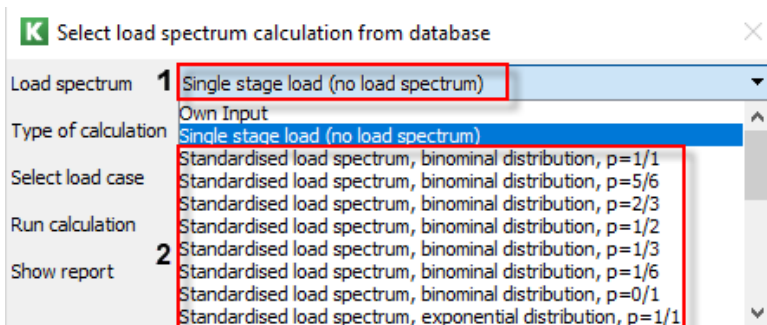


Figure 2. Select load spectrum („Single stage load“ or load spectrum from database) from list

3.1.1 Select from database

In the KISSsoft database, the user can add his own load spectra. Later, he can select these load spectra for calculation in KISSsys. To edit (e.g. to add a new load spectrum to the database) the database, use the database tool (close KISSsys and start KISSsoft as “Administrator”) in KISSsoft (not in KISSsys).

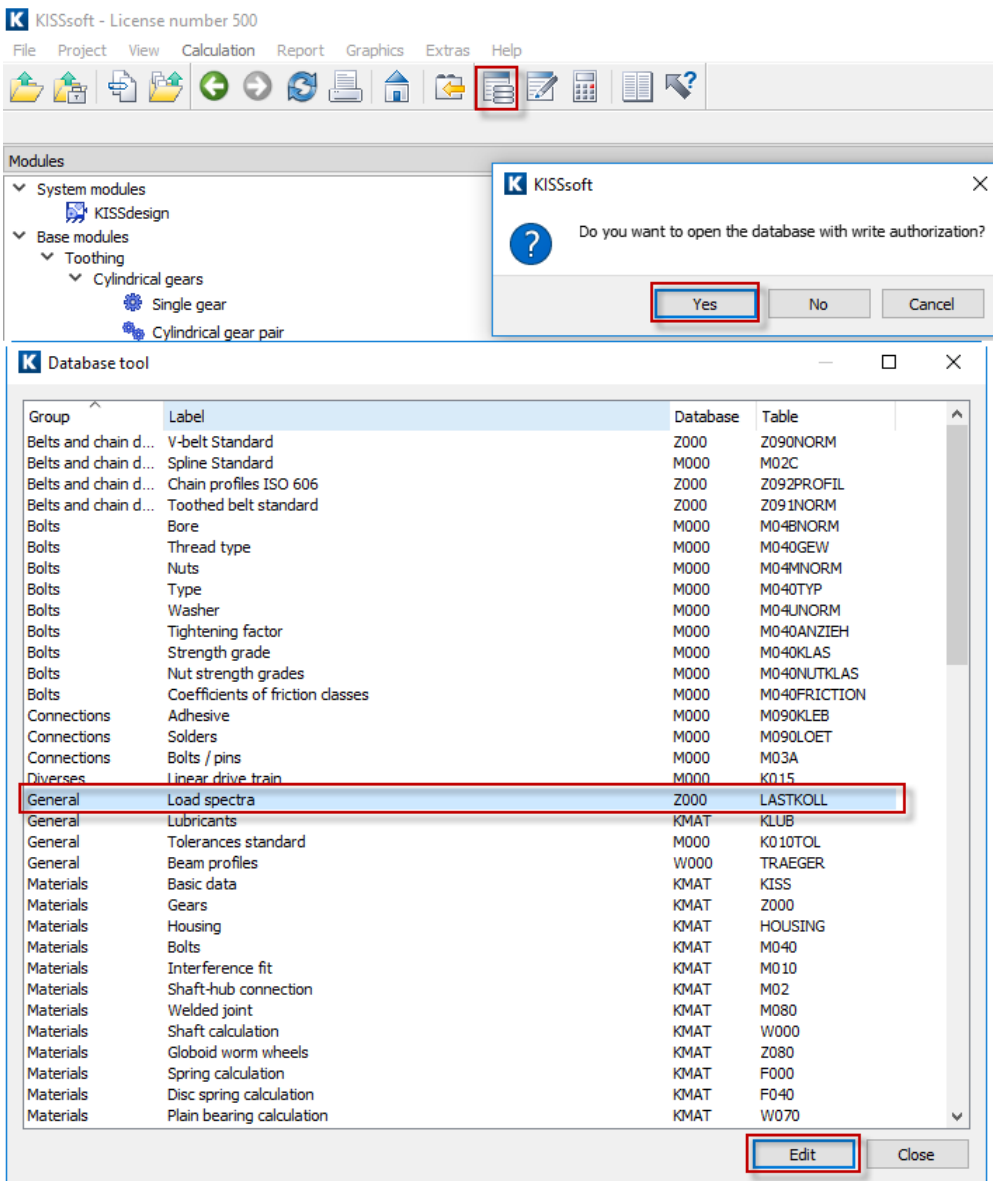



Figure 3. Opening the KISSsoft database tool

Open the Table named “LASTKOLL” and add a new load spectrum e.g. “KISSsys-ANL-14-908-Example-LDD” as described below.

Add e.g. a new load spectrum named “KISSsys-ANL-14-908-Example-LDD” as follows (press the  button and enter)

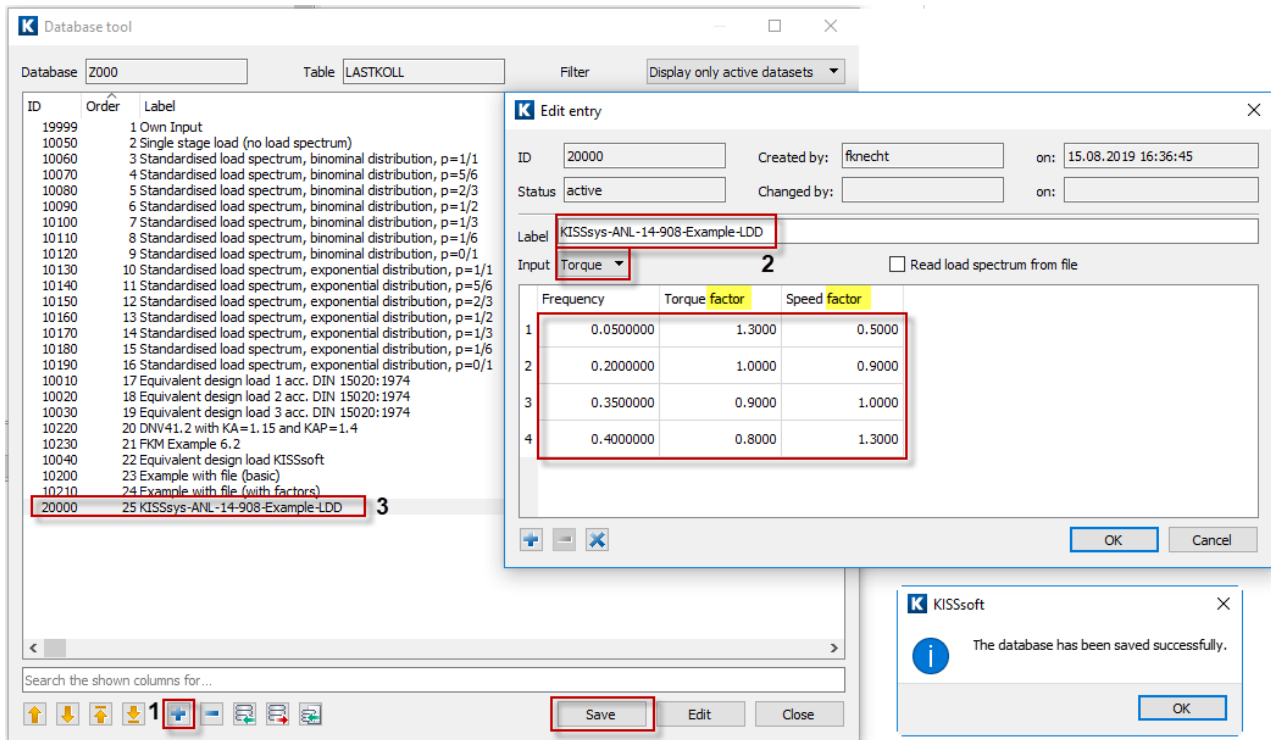


Figure 4. Adding a load spectrum in the database tool.

In order to calculate the load spectrum without changing the kinematic, it must be defined with **factors** and not absolute values.

Press “Ok”, “Save” and “Close” to complete and save the input. You can now select this new load spectrum from the database. By doing this, the load spectrum is set to all the elements in the three structure (but the flag to consider load spectrum is not set).

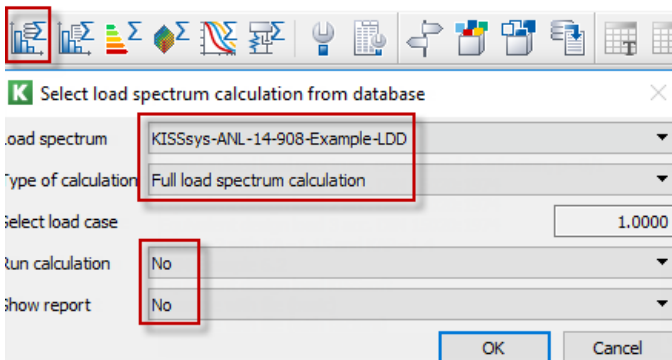


Figure 5. Choose defined loadspectrum from database

Then, a new window / table will be created by KISSsys, showing the load spectrum (note that you cannot edit this load spectrum in KISSsys level as it is imported from a database):

| | Frequency | TorqueOrPower | Speed |
|---|-----------|---------------|-------|
| 1 | 0.05 | 1.3 | 0.5 |
| 2 | 0.2 | 1 | 0.9 |
| 3 | 0.35 | 0.9 | 1 |
| 4 | 0.4 | 0.8 | 1.3 |

Figure 6. Load spectrum imported from database into KISSsys table.

3.1.2 Use nominal load calculation

Once you select “Single stage (no collective)”, the load spectrum will be removed from the whole model including all single elements. The user can thereby perform a “proper” nominal calculation with this selection to clean up the model (see following figure)

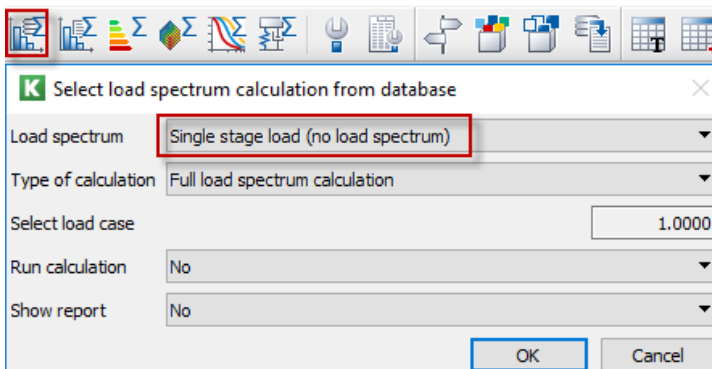


Figure 7. Selecting „Single stage load (no load spectrum)“

3.2 Calculation with load spectrum

To run the calculations with load spectrum, simply select “Yes” in the corresponding field.

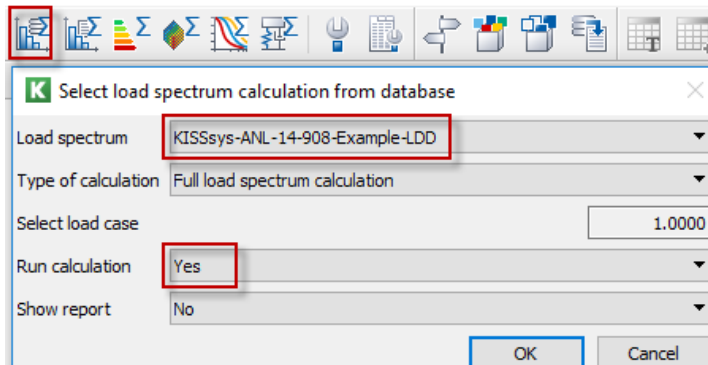


Figure 8. Running the calculation

Note that the flag “Consider load spectrum” is then only **TEMPORARILY** set to all calculations so that if you press the button Σ or Σ , then, the calculation will be done with its initial settings (if the user sets the flag manually in the calculation file, it is then calculated with load spectrum, otherwise with the nominal load).

When you run the calculation with load spectrum, the resulting gear and shaft safety factors and bearing life will be based on the load spectrum.

After running the calculation, you can see the load spectrum e.g. in the gear calculation.

Basic data Reference profile Manufacturing Tolerances Rating Factors

Strength

Calculation method ISO 6336:2006 Method B

Calculation method scuffing according to calculation method

Calculation method for micropitting ISO/TS 6336-22

Calculation method tooth flank fracture No calculation

Driving gear Gear 1

Working flank gear 1 right flank

Sense of rotation gear 1 clockwise

Reference gear Gear 1

Power P 2.0944 kW

Torque T_1 10.0000 Nm

Speed n_1 2000.0000 1/min

Required service life H 3000.0000 h

Application factor K_A 1.2500

Load spectrum

KISSsys-ANL-14-908-Example-LDD

Don't consider load spectra

| | Frequency [%] | Power factor | Speed factor | $K_{H\beta}$ |
|---|---------------|--------------|--------------|--------------|
| 1 | 5.000000 | 0.6500 | 0.5000 | 1.0000 |
| 2 | 20.000000 | 0.9000 | 0.9000 | 1.0000 |
| 3 | 35.000000 | 0.9000 | 1.0000 | 1.0000 |

Input Power Factor

Figure 9. Definition of the load spectra in the gear calculation

Or also in the shaft calculation

Element Tree Shaft editor 3D Viewer Basic data Strength Cylindrical gear

Overview

- Shaft1
 - Outer contour
 - Cylinder
 - Cylinder
 - Cylinder
 - Inner contour
 - Forces
 - Coupling1...
 - Gear1
 - Bearing
 - B1
 - B2
 - Cross sections
 - Connecting elements

Projects Element Tree Manual

3D Viewer

Cylindrical gear

Read data from file

Take stiffness matrix into account

Label Gear 1

Position of cylindrical gear on shaft y 44.0000 mm

Position of cylindrical gear in global system Y 44.0000 mm

Multiple counter gears

Position of contact α_{pos} -0.0000 °

Length of load application l 15.0000 mm

Operating pitch diameter d_w 40.0000 mm

Working pressure angle at normal section α_{in} 17.4928 °

Number of teeth (only for display) z 20

Hand of gear helix right hand

Helix angle at operating pitch circle β_w 9.8511 °

Power P 2.0944 kW

Torque T 10.0000 Nm

Direction driving (output)

Load spectrum KISSsys-ANL-14-908-Example-LDD

Figure 10. Definition of the load spectra in the shaft calculation

3.3 Single load step calculation

Like in KISSsoft, a single load step calculation can be performed with the selection below. The user can also select what bin to calculate. Once again, the flag is set only temporarily in the KISSsoft file.

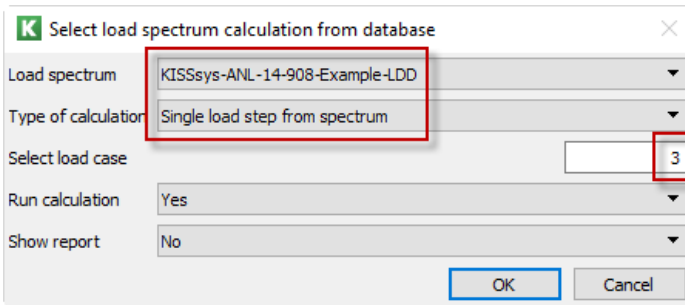


Figure 11. Single load step calculation

4 Example

4.1 File to start with

Open the below file to start and select administrator mode:

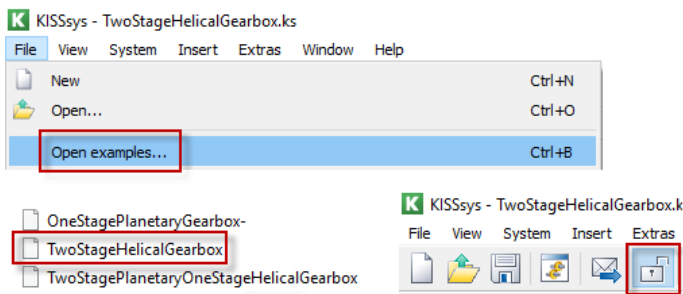


Figure 12. Open example file „TwoStageHelicalGearbox.k“ and select administrator mode

4.2 Adding bearing life to user interface

Let us now add the resulting bearing lifetime to the user interface (and add some text). First, enter “Bearing Life B1 (h)” in the corresponding cell (see following figure). Then, use right mouse click on “B1” and select “Properties”. Then, mark the target cell and select the variable “Lh” and press “Insert as expression”.

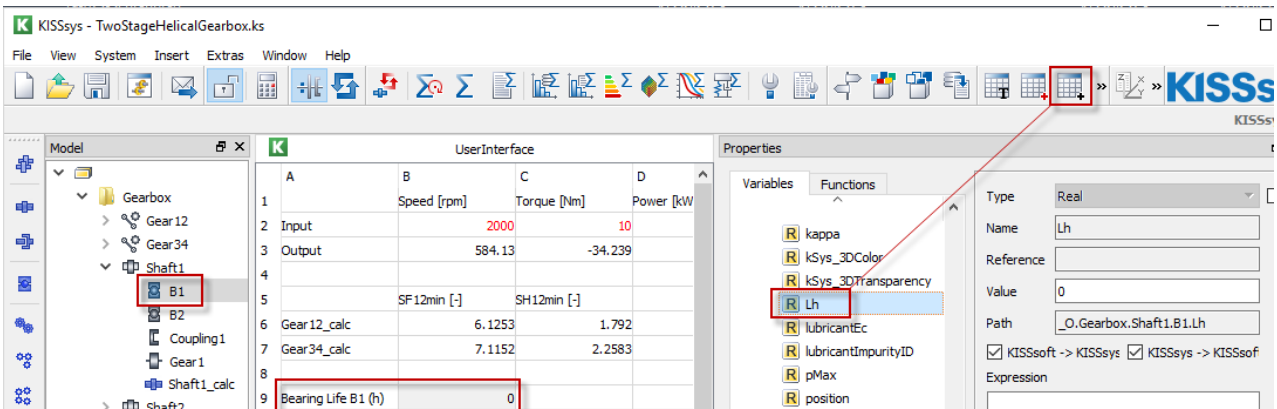
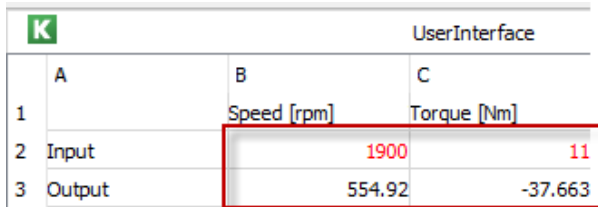


Figure 13. Adding a bearing life to the user interface

4.3 Calculation without load spectrum


To run a calculation without a load spectrum and e.g. with an input speed of 1900Rpm and an input torque of 11Nm, proceed as follows:


- 1) Enter speed and torque in the "UserInterface"



| K UserInterface | | |
|-----------------|-------------|-------------|
| A | B | C |
| 1 | Speed [rpm] | Torque [Nm] |
| 2 Input | 1900 | 11 |
| 3 Output | 554.92 | -37.663 |

Figure 14. Nominal speed and torque input

- 2) Run kinematic calculation by pressing 

- 3) Run strength calculation by pressing 

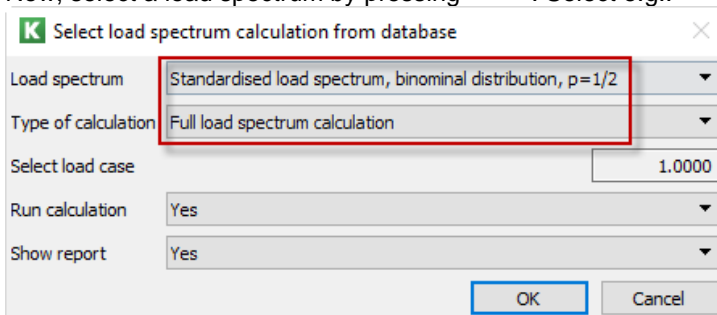
The following results will appear in the UI:

| | SF12min [-] | SH12min [-] |
|---------------------|-------------|-------------|
| Gear12_calc | 6.2349 | 1.6996 |
| Gear34_calc | 7.261 | 2.1454 |
| | | |
| Bearing Life B1 (h) | 15842.51574 | |

Figure 15. Nominal load calculation - results

4.4 Calculation with load spectrum

Now, select a load spectrum by pressing . Select e.g.:



Select load spectrum calculation from database

Load spectrum: Standardised load spectrum, binominal distribution, p=1/2

Type of calculation: Full load spectrum calculation

Select load case: 1.0000

Run calculation: Yes

Show report: Yes

OK Cancel

Figure 16. Spectrum selection

The load spectrum is shown as below:

| UserInterface | | LoadSpectrumFromDB | |
|---------------|---------------|--------------------|---|
| Frequency | TorqueOrPower | Speed | |
| 1 | 2e-006 | 1 | 1 |
| 2 | 1.6e-005 | 0.975 | 1 |
| 3 | 0.00028 | 0.925 | 1 |
| 4 | 0.00272 | 0.863 | 1 |
| 5 | 0.02 | 0.788 | 1 |
| 6 | 0.092 | 0.713 | 1 |
| 7 | 0.28 | 0.638 | 1 |
| 8 | 0.60498 | 0.563 | 1 |

Figure 17. Spectrum definition

Then, run the load spectrum calculation with the corresponding button, you will get as result:

| | SF12min [-] | SH12min [-] |
|---------------------|-------------|-------------|
| Gear12_calc | 7.9175 | 2.0407 |
| Gear34_calc | 8.9679 | 2.463 |
| Bearing Life B1 (h) | 60657.5804 | |

Figure 18. Spectrum calculation results

4.5 Calculation without load spectrum

Now, a load spectrum is defined. But if you again press , the result will again be for the nominal load.

5 Messages

5.1 Message about application factor

By default, an application factor of $KA=1.25$ is used in the gear calculations. When you use a load spectrum, the application factor should be set to $KA=1.00$ in all individual gear calculations (because we use a load spectrum instead of an application factor). KISSsys checks whether any of the KISSsoft gear calculation still has an application factor KA different to 1.00. If so, you will get the below message. Note that the calculation will also run if the application factors are not equal to 1.00. Then, the application factor will be used together with the load spectrum.

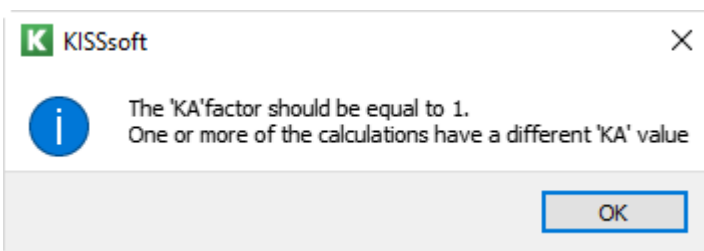


Figure 19. Message stating that KA should be equal to 1

5.2 Message if you are not in administrator mode

If you want to enter your own load spectrum using “Own input” but you are not in administrator mode, you will get the below message. Activate the administrator mode to avoid this.

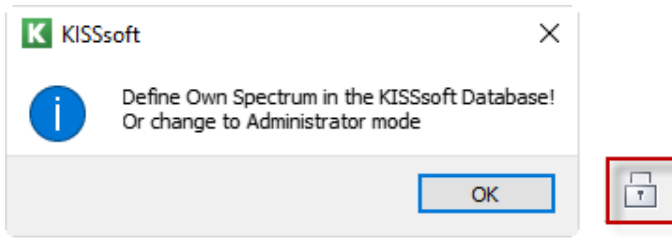


Figure 20. Restrictions without the activation of administrator rights