

KISSsys 2020 – Instruction 0021

KISSsys default load spectrum calculation

T. +41 55 254 20 50 F. +41 55 254 20 51 info@KISSsoft.com www.KISSsoft.com

Sharing Knowledge

Contents

1 Doc	ument information	3
1.1	Document change record	3
2 Intro	duction	3
2.1	Load spectrum definition in KISSsoft database	3
3 Usin	g the KISSsys functions	3
3.1	Select a load spectrum	3
3.1.1	Select from database	4
3.1.2	Use nominal load calculation	6
3.2	Calculation with load spectrum	6
3.3	Single load step calculation	8
4 Exa	mple	8
4.1	File to start with	8
4.2	Adding bearing life to user interface	8
4.3	Calculation without load spectrum	9
4.4	Calculation with load spectrum	9
4.5	Calculation without load spectrum	10
5 Mes	sages	10
5.1	Message about application factor	
5.2	Message if you are not in administrator mode	11

1 Document information

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

1.1 Document change record

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 <u>load spectrum template</u> (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).

Κ	KISSsys	- TwoStag	eHelical	Gearbox.	ks													
File	View	System	Insert	Extras	Window	Help												
	<u></u>	,		Ţ		F 🗗	\$	ΣΩ	Σ	Σ	ĮΈΣ	LΣ	Σ	φΣ	V	₹ŢΣ		
					cal	culat	ion	from	n da	taba	ase	/ ca	Icul	atic	on fi	om	temp	late

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.

K Select load spectrum calculation from database Load spectrum 1 Single stage load (no load spectrum) Own Input Type of calculation Standardised load spectrum, binominal distribution, p=1/1 Select load case Standardised load spectrum, binominal distribution, p=5/6 Standardised load spectrum, binominal distribution, p=2/3 Run calculation Standardised load spectrum, binominal distribution, p=1/2 Standardised load spectrum, binominal distribution, p=1/3 2 Show report standardised load spectrum, binominal distribution, p=1/6 Standardised load spectrum, binominal distribution, p=0/1 Standardised load spectrum, exponential distribution, p=1/1

Figure 2. Select load spectrum ("Singe 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).

KISSsoft - License	e number 500						
e Project View	Calculation Report Graphics Extras	Help					
- 🚖 🖧 🖟	🔄 🛆 🔿 🙉 💷 📥 📪 🚺] 📢 ?			
		8 2					
dules		-					
System modules		KISSs KISSs	oft				
KISSdesig	n						
Base modules			Do you w	ant to open the	database with wri	ite author	izatio
✓ Toothing							
 Cylindrical 	gears	-			_		
86 c	ingle gear			Vec	No	Car	col
	ingle gear			Tes		Car	icei
®@ C	ylindrical gear pair			-			
C Database tool							×
-							
Group	Label			Database	Table		~
Belts and chain d	V-belt Standard			7000	2090NORM		
Belts and chain d	Spline Standard			M000	M02C		
Belts and chain d	Chain profiles ISO 606			7000	7092PROFT		
Belts and chain d	Toothed belt standard			2000	20021 1001 1E		
Bolte	Bore			2000 M000	MOARNORM		
Bolts	Thread type			M000	M040GEW		
Bolts	Nute			M000	MO4MNORM		
Bolts	Type			M000	M040TVD		
Bolts	Washer			M000			
Bolts	Tightening factor			M000			
Bolts	Strength grade			M000			
Polto	Surengui grade			M000			
Polto	Coefficients of friction damage			M000			
Connections	Adherive			M000	MODOVIER		
Connections	Soldera			M000	M000LED		
Connections	Soluel's			M000	MO2A		
Diverses	boits / pins			MOOD	MUSA KO1E		
Conoral	Lond constra			7000	LASTROLL		
Conoral	Lubricante			ZUUU			
Conoral	Tolerances standard			MOOO	KLUD		
Coporal	Peam profiles			M000	TRAFCER		
Materiale	Pagic data			VV000	VICC		
Materiale	Coord			KMAT	7000		
Materials	ucais Housing			KMAT	LOUISTING		
Materials	Polto			KMAT	M040		
Materials	Dolls Interference ft			NMAT	MOTO		
Materials	Interierence fit			KMAT	M010		
Materials	Strait Fruit Connection			KMAT	MORO		
Materials	Weided Joint Chaft calculation			KMAT	M080		
Materials	Shart Calculation			KMAT	7090		
Materials	Giobold Worm Wheels			KMAT	2080		
Materials	Spring calculation			KMAI	F000		
Materials	Disc spring calculation			KMAT	F040		
materials	Plain bearing calculation			KMAT	W070		¥
					Edit	Close	
					Luit	Ciuse	

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*)

K Datab	ase tool							×				
Database	Z000	Table	LASTKOLL]	Filter	Display only active	datasets	•				
ID	Order Label			K E	dit entry							×
19999 1 Own Input 10050 2 Single stage load (no load spectrum) 10060 3 Standardised load spectrum, binominal distribution, p=1/1 10070 4 Standardised load spectrum, binominal distribution, p=5/6 10080 5 Standardised load spectrum, binominal distribution, p=2/3 10090 6 Standardised load spectrum, binominal distribution, p=1/2 10090 6 Standardised load spectrum, binominal distribution, p=1/2					20000 s active		Created by: Changed by	fknecht :] on:] on:	15.08.2019 16:36	5:45
10110 10120 10130 10140	8 Standardised 9 Standardised 10 Standardised 11 Standardised	oad spectrum, bind oad spectrum, bind oad spectrum, exp	minal distribution, $p = 1/6$ minal distribution, $p = 0/1$ onential distribution, $p = 1/1$ opential distribution, $p = 5/6$	Label Input	KISSsys-ANL-14	-908-Example-LDI	2		Read load spect	trum from	file	
10140 10150 10160 10170	12 Standardised 12 Standardised 13 Standardised 14 Standardised	oad spectrum, exp oad spectrum, exp oad spectrum, exp oad spectrum, exp	onential distribution, p=2/3 onential distribution, p=1/2 onential distribution, p=1/3	F 1	requency 0.0500000	Torque factor	Speed 1	factor 0.5000				
10180 10190 10010	16 Standardised I 16 Standardised I 17 Equivalent des	oad spectrum, exp oad spectrum, exp sign load 1 acc. DIN	phential distribution, $p=1/6$ phential distribution, $p=0/1$ 15020:1974	2	0.2000000	1.00	00	0.9000				
10020 10030 10220 10230	18 Equivalent des 19 Equivalent des 20 DNV41.2 with 21 FKM Example	sign load 2 acc. DIN sign load 3 acc. DIN KA=1.15 and KAP= 5.2	15020:1974 15020:1974 =1.4	3	0.350000	0.90	00	1.0000				
10040 10200 10210	22 Equivalent des 23 Example with 24 Example with	sign load KISSsoft file (basic) file (with factors)	- 2									
20000	25 KISSsys-ANL-	14-908-Example-LD	5	+	- 🗙						OK	Cancel
									K KISSsoft			×
<	e shown columns for							>	1 The o	database h	has been saved suc	ccessfully.
		₹ 3 2			Save	Edit	Close					ОК

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

In order to calculate the load spectrum without changing the kinematic, it <u>must be defined</u> 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 <u>set to all the elements in the three structure</u> (but the flag to consider load spectrum is not set).

μέζ με 💵	مΣ 🐺 🖅 🚆 🗧	f 🎁 🕤	9
K Select load s	pectrum calculation from database	2	\times
.oad spectrum	KISSsys-ANL-14-908-Example-LDD		•
ype of calculation	Full load spectrum calculation		•
elect load case			1.0000
tun calculation	No		•
how report	No		•
		OK	Cancel

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):

	K	LoadSpectrumFrom	DB
	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)

έ μΣ	♦٢ 💯 😤 🐺 🏹	*	5	1	T	
K Select load s	pectrum calculation from database					\times
Load spectrum	Single stage load (no load spectrum)	1				•
Type of calculation	Full load spectrum calculation	-				•
Select load case					1.	0000
Run calculation	No					•
Show report	No					•
		C	ж		Cano	el

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.

Ε	i 🖓 📲 📲 🖉 🏹	8	5	T	₩,
K Select load s	pectrum calculation from database				\times
Load spectrum	KISSsys-ANL-14-908-Example-LDD				•
Type of calculation	Full load spectrum calculation				-
Select load case				1.	0000
Run calculation	Yes				•
Show report	No				•
		ОК		Cance	el

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 \mathbb{E} , 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.

							1							
Basic (lata Reference	profile N	lanufactu	uring Tolerances	Rating	Factors								
Stre	igth													
Cala	dation mathed		150	6226,2006 Mathed	5		-		D-6				De	4-11-
Calc	uauon metriou		150	6556;2006 Method I	2		•		Reference gea		Details			
Calc	ulation method scuff	fing	according to calculation method 🔹				Power	Р	2.0944	kW	۲	L.		
Calc	ulation method for n	nicropitting	ISO/	TS 6336-22			•	+	Torque	T ₁	10.0000	Nm	0	+
Calc	ulation method toot	n flank fractu	ure No c	alculation			•		Speed	n ₁	2000.0000	1/min	0	بۇ -
Drivi	ng gear		Gear	ear 1 🗸 👻				Required servi	ce life H	3000.0000	h		+ +	
Wor	king flank gear 1	gear 1 right flank				•	1	Application fac	tor K _A	1.2500			1	
Sens	e of rotation gear 1	L					clockwise							
Load	spectrum													
KIS	Ssys-ANL-14-908-Ex	kample-LDD		•	1					Don't consider	load spectra			•
	Frequency [%]	Power facto	or	Speed factor	К _{нв}									^
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

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.

K Select load s	pectrum calculation from database	e	×
Load spectrum	KISSsys-ANL-14-908-Example-LDD		•
Type of calculation	Single load step from spectrum		-
Select load case		2	3
Run calculation	Yes		-
Show report	No		•
		ОК	Cancel

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.ks" 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"



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 [-]	
6.2349		1.6996
7.261		2.1454
15842.51574	•	
	SF 12min [-] 6.2349 7.261 15842.51574	SF12min [-] SH12min [-] 6.2349 7.261 15842.51574

Figure 15. Nominal load calculation - results

4.4 Calculation with load spectrum

Now, select a	load spectrum by pressing	e.g.:			
K Select load spectrum calculation from database $ imes$					
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	•			
	ОК	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 [-]
Gear 12_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 **2**, 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