

Supplementary Information concerning Load Spectrum Calculation in the Shafts and Gears Module

Gears Module

Defining a load spectrum

Lastkollektiv

Normkollektiv, binominalverteilt, p=5/6 ☒ Lastkollektiv berücksichtigen

	Häufigkeit [%]	Leistung [kW]	Drehmoment [Nm]	Drehzahl [1/min]	$K_{H\beta}$
1	0.000200	75.0000	1624.7669	440.8000	1.0000
2	0.001600	74.4000	1611.7688	440.8000	1.0000
3	0.028000	73.1250	1584.1477	440.8000	1.0000
4	0.272000	71.5500	1550.0276	440.8000	1.0000
5	2.000000	69.6750	1509.4084	440.8000	1.0000

Load spectrum group

In this group you can access load spectra that have been stored in the database. You can also define the load spectra directly.

If you select **Load**, the system can load a file (either *.txt or *.dat) containing a load spectrum.

You will find an example file that shows you how a load spectrum can be defined in the 'Example_DutyCycle.dat' file in the **dat** sub-directory in the KISSsoft installation directory.

If separate factors ($K_{H\beta}$, K_{α} , etc.) are to be taken into account for each load spectrum element, during calculation, then you must make the appropriate settings in the **Factors** tab for the load distribution coefficient K_{α} , the alternating bending factor Y_M and the face load factor K_H . You will find an example file that shows you how a load spectrum with factors ($K_{H\beta}$, K_{α} , etc.) can be defined in the 'Example_DutyCycle.dat' file in the **dat** sub-directory in the KISSsoft installation directory.

Type of load spectrum

The calculation of service life for load spectra is performed as specified in ISO 6336, Part 6, and is based on the Palmgren-Miner rule.

Here, three load spectra are predefined as shown in DIN 15020 (Lifting Appliances) along with many other standard spectra. You can enter your own load spectra.

A load spectrum consists of several elements (up to 50 in the database or an unlimited number if imported from a file). Each element consists of the frequency, speed, and power or torque. The data always refers to the reference gear you selected when you input the nominal power (Performance- Torque- Speed screen). The program stores these values as coefficients so that they are modified automatically when the nominal power changes.

If two speeds that are not equal to zero have been predefined for planetary stages, you can select two load spectra. In this case, only the speed factor is important for the second load spectrum.

Note

The load dependency of the K-Factors are included in the calculation (K-coefficients: dynamic, face load and transverse coefficients). If you want to examine the result in greater detail, you will find the most interesting interim results in the Z18-H1.TMP text file (in the TMP directory).

Load spectra with negative elements

Load spectra with negative load spectrum elements ($T < 0$ and/or $n < 0$) are calculated as follows (is only applied to elements whose alternating bending factor is $Y_M=1.0$).

IMPORTANT:

A load spectrum element is evaluated as negative if the mating flank is placed under load. The same definition is used for the speed and torque (or power) prefix as in KISSsys.

Consequently, the following elements are evaluated as negative:

Factor for torque or power	Factor for speed	Flank under load	Actual load spectrum element
+	+	Working flank (*)	Evaluated as positive
+	-	Working flank (*)	Evaluated as positive
-	+	Mating flank	Evaluated as negative
-	-	Mating flank	Evaluated as negative

(*) Working flank as entered in the Strength tab

Under `Details` in the `Rating` tab, group `Strength`, you can select the following:

- For calculating pitting safety
 - o Evaluate all negative load spectrum elements as positive (as up to now)
 - o Only evaluate positive load spectrum elements
 - o Only evaluate negative load spectrum elements
- For calculating the tooth root safety:
 - o Evaluate all load spectrum elements (as up to now)
 - o For negative load spectrum elements Root stress with $1/0.7$ increase
 - o For positive load spectrum elements Root stress with $1/0.7$ increase

Shafts Module

Load spectra

If the loads defined in the Shaft Editor have been assigned a load spectrum, the deformation can be calculated either for the nominal load or for any element of the load spectrum. To do this, select the Consider load spectra option from the Load spectra drop-down list. If you only want to take into account one

element from the load spectrum, you should select Consider only one element of the load spectrum. Enter the relevant element number in the input field to the right of the drop-down list.

Load spectra with negative elements

Load spectra with negative load spectrum elements ($T < 0$ and/or $n < 0$) are handled as follows:

Factor for torque or power	Factor for speed	Shaft direction of rotation	Force element
+	+	-	-
+	-	C	D
-	+	-	D
-	-	C	-

- = unchanged

C = direction of rotation changes clockwise/counterclockwise

P = driving/driven changes