DEUTSCHE NORM Oktober 2

Tragfähigkeitsberechnung von Wellen und Achsen
Teil 1: Einführung, Grundlagen

DIN 743-1

ICS 21.120.10

Shafts and axles, calculation of load capacity – Part 1: General basis

Calcul de la capacité des arbres et axes – Partie 1: Base

DIN 743:2012

Verifications of the software

Inhalt

KISSsoft AG, A Gleason Company
Rosengartenstrasse 4, 8608 Bubikon, Switzerland
T. +41 55 254 20 50, info@KISSsoft.AG, www.KISSsoft.AG

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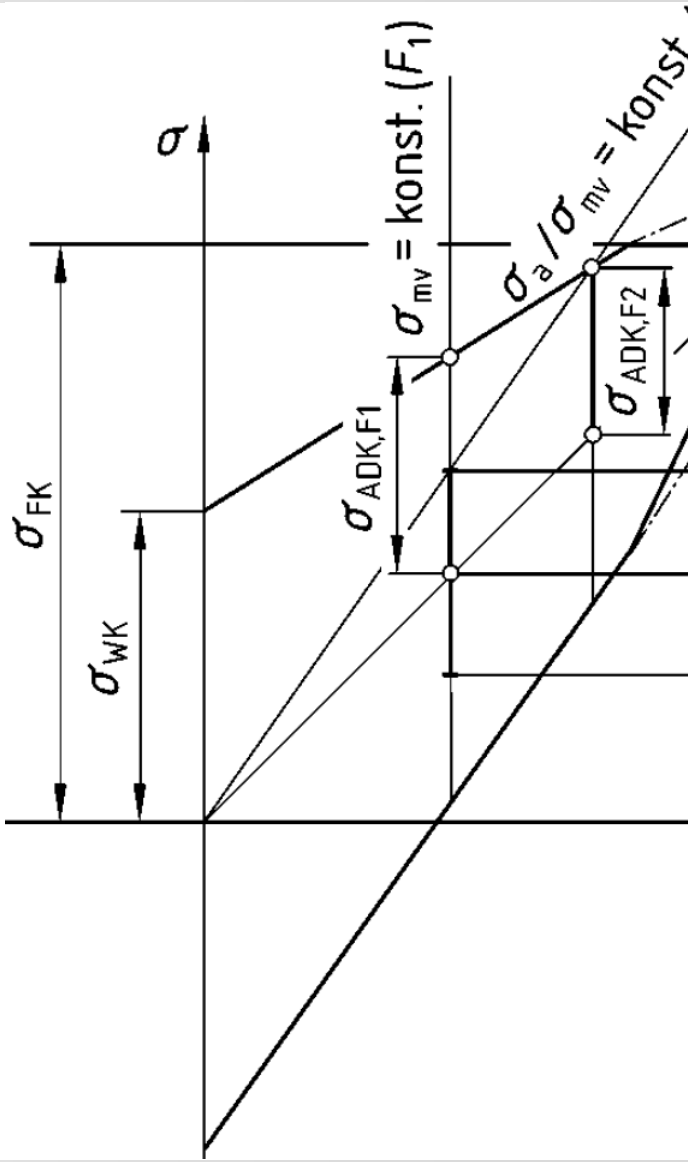


1. Current situation

DIN 743:2012 is the only valid revision, other revisions are withdrawn

Previous versions of DIN 743 are no longer valid. Refer to www.din.de.

Contractual documents or certification guidelines that refer to DIN 743 technically refer to the current revision (2012). Documents (calculation reports, contracts, specifications, certification guidelines, …) therefore need either to be specific (e.g. identifying the revision to be used) or updated.

The DIN standard is the most widely recognized standard for shaft rating besides AGMA 6101. In some industries, e.g. wind industry, it is globally accepted. There is no ISO standard on shaft strength rating.

DIN Standards Committee Mechanical Engineering

About NAM | Projects | Drafts | DIN SPEC | Standards | Documents withdrawn w

STANDARDS

DIN 743-1
Calculation of load capacity of shafts and axles - Part 1: General

Title (German)
Tragfähigkeitsberechnung von Wellen und Achsen - Teil 1: Grundlagen

Overview

A large number of failures in mechanical engineering is due to damage to axles and shafts. The most frequent cause for this is fatigue failure (fatigue fractures, vibration fractures). In addition to the optimum structural design, the calculation of the safety against the occurrence of fatigue failure and damage due to maximum load (permanent deformation, precrack) presents a necessary measure. This standard contains the basic equations and the methodology for proof of load bearing capacity for shafts and axles. This standard has been prepared by Working Committee NA 060-34-32 AA "Wellen und Welle-Nabe-Verbindungen" ("Shafts and shaft to collar connections") at the Technical Section Power transmission engineering of the Mechanical Engineering Standards Committee (NAM) at DIN, the German Institute for Standardization e. V. The DIN 743 standard series - Shafts and axles, calculation of load capacity - consists of - Part 1: General basics; - Part 2: Theoretical stress concentration factors and fatigue notch factors; - Part 3: Strength of material; - Part 4: Fatigue limit, endurance limit - Equivalently damaging continuous stress; - Supplement 1: Examples to Part 1 to 3; - Supplement 2: Examples to Part 4. The following modifications have been made with respect to DIN 743:2000-10, clause 5: a) for static proof a distinction between the proof of avoidance of permanent deformation and the proof of the avoidance of precracks of hard surface layers has been made; b) determination of the crack boundary has been supplemented. Previous editions: DIN 743-1:1998-05, 2000-10.

Document: references other documents

Document: referenced in other documents

Responsible national committee

NA 060-34-32 AA - Shafts and shaft-hub-connections >

EDITION	ORIGINAL LANGUAGE	TRANSLATION	PRICE
2012-12	German	English	from 81.60 €

KISSsoft

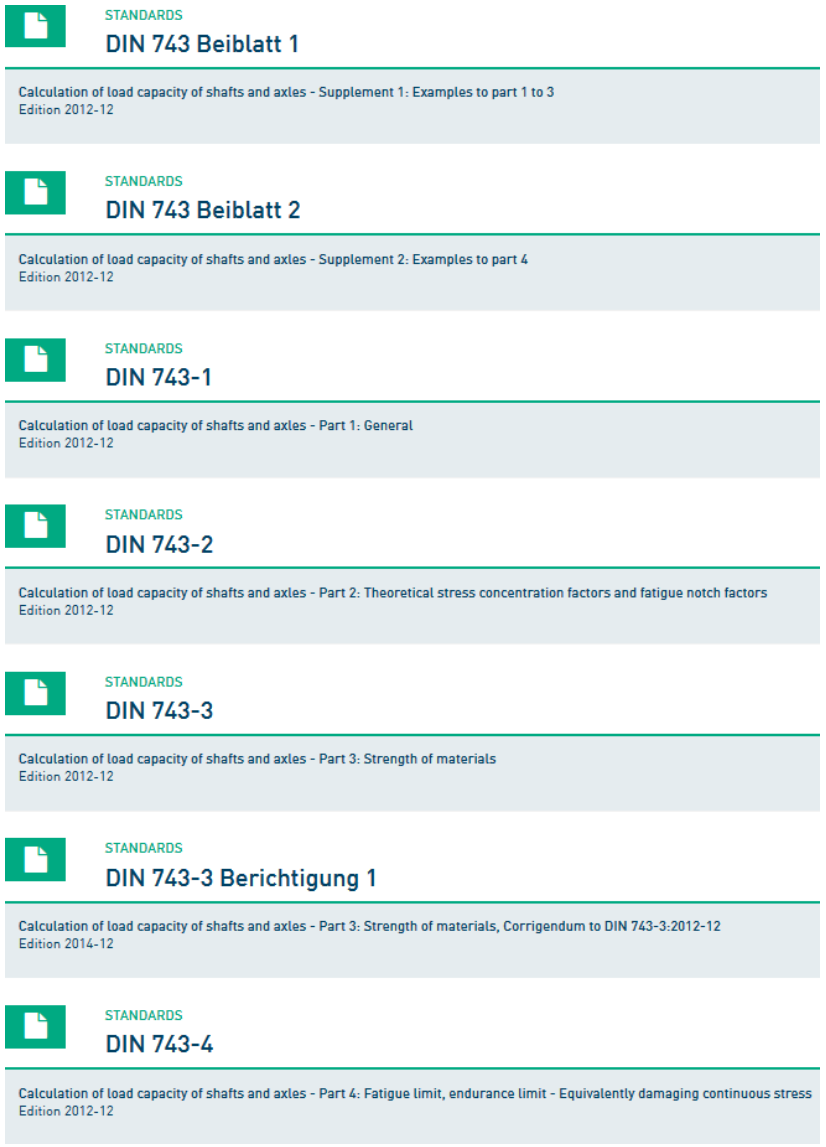
1. Current situation

DIN 743 overview

DIN 743 consists of seven documents. There are four parts, DIN 743-1, -2, -3, -4, two supplements “Beiblatt 1” and “Beiblatt 2” and one correction “Berichtigung 1”

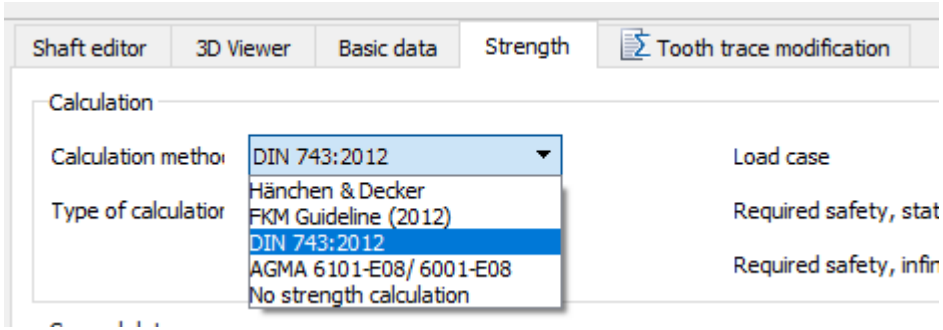
The supplements contain calculation examples that are used for software verification.

KISSsoft uses the methods, material data and formulas as defined in parts 1, 2, 3, 4.

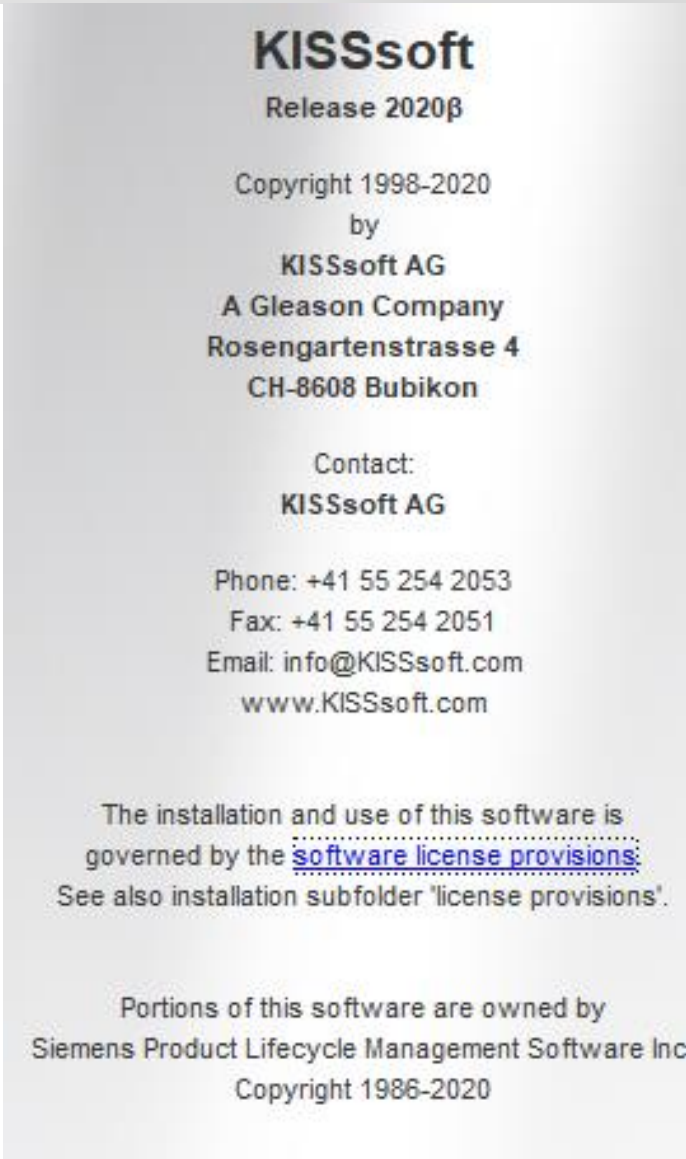


Software release 2020

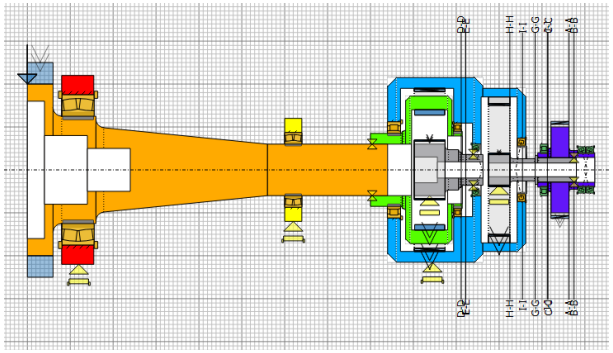
Shaft rating along DIN 743, along with other methods, is implemented in KISSsoft.

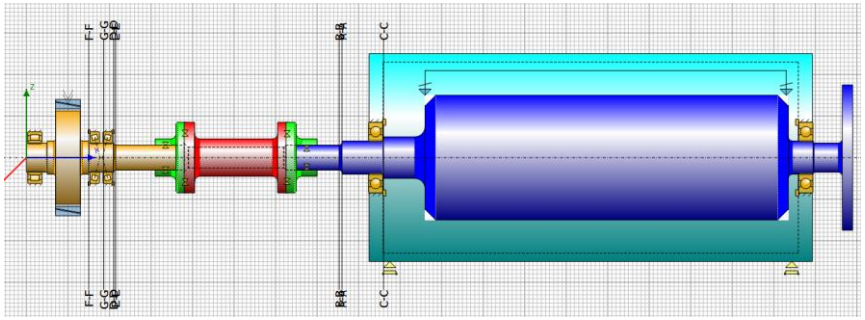


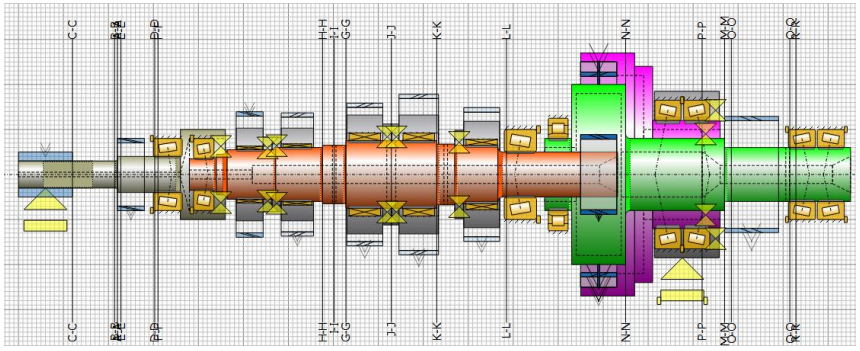
Also, shaft deformation and bearing force calculation, considering non-linear bearing stiffness, is included in KISSsoft. Beam theory, either as per Euler or as per Timoshenko is used. Linear or non-linear calculations are available. Several single shafts may be combined to form a – coaxial – shaft system.

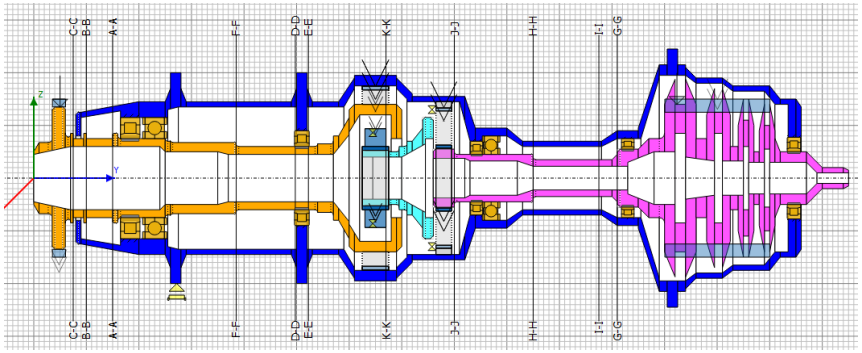


Models of shaft systems









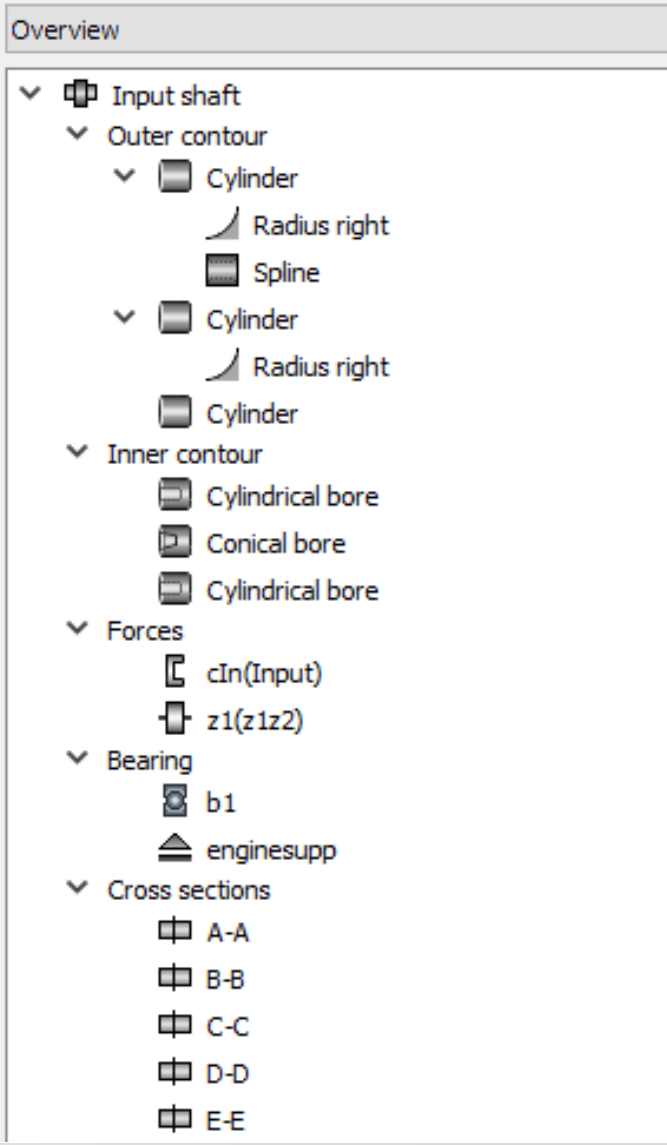
Shaft model

Every shaft consists of

- The geometry (inner and outer contour) → defining the cross-sectional properties like A, I, W
- The features / notches → defining form factors α and notch factors β
- Bearings, as supports or rolling element bearings → defining the boundary conditions
- Forces, as force vectors or elements like gears → defining cross sectional forces like Fa, Mb, T

From the cross-sectional properties and the cross sectional forces, nominal stresses σ and τ are calculated.

From the material properties and the notch factor, part strength is calculated.

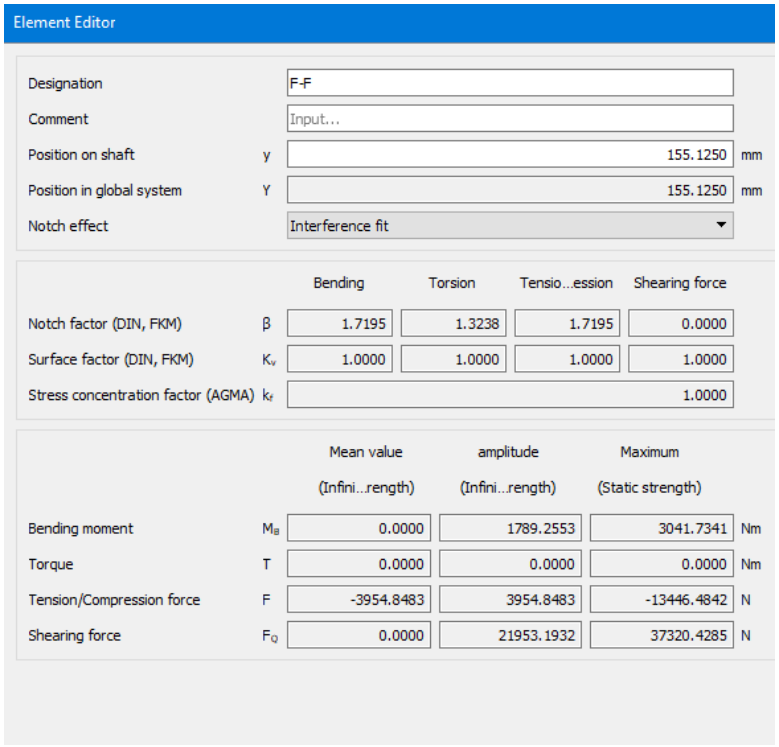


Cross sectional properties

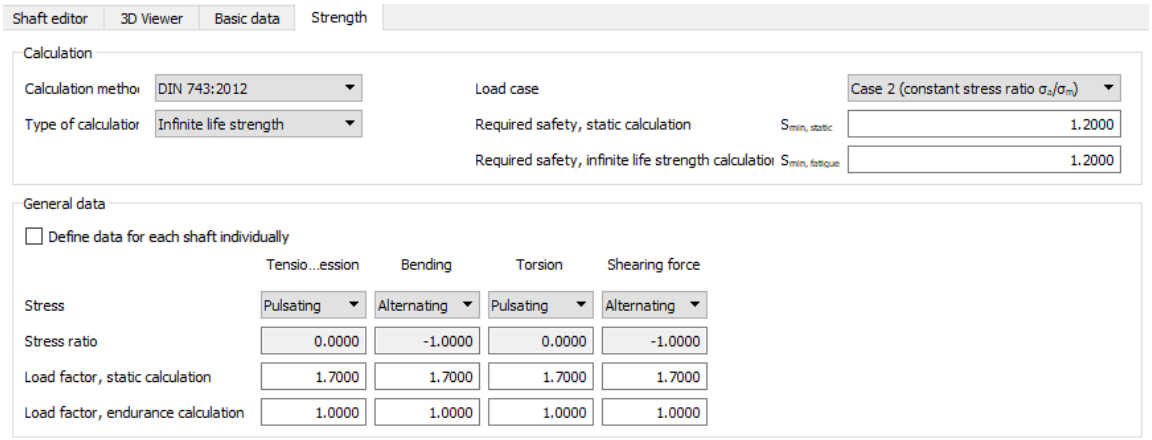
For each calculated cross section A-A, B-B, C-C, …

The notch factor and other K factors are determined.

From the sytem equilibrium, cross sectional forces (bending moment, torque, tension, shear force) is known.



Settings for strength rating



Different calculation method may be selected.

The calculation is done for static and fatigue rating.

For fatigue rating, finite life or infinite life calculation is possible.

Load spectra may be considered.

Different stress ratios may be selected.

Target safety factors are used to calculate utilizations.

Results

Results (basic calculation)

Results

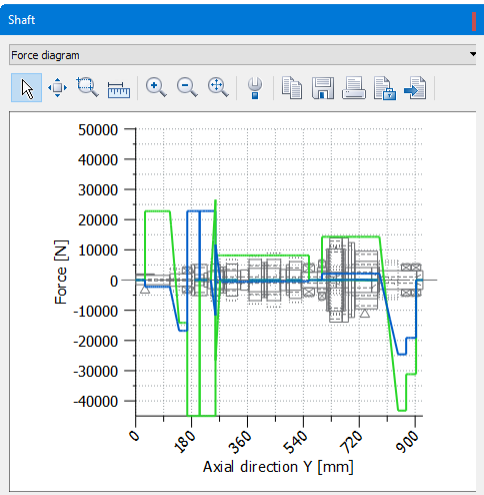
maximum deflection	546.82 µm
maximum equivalent stress	882.11 N/mm²
minimum bearing rating life	5.98 h
minimum static bearing safety	1.46
minimum fatigue safety	0.19
minimum static safety	0.27

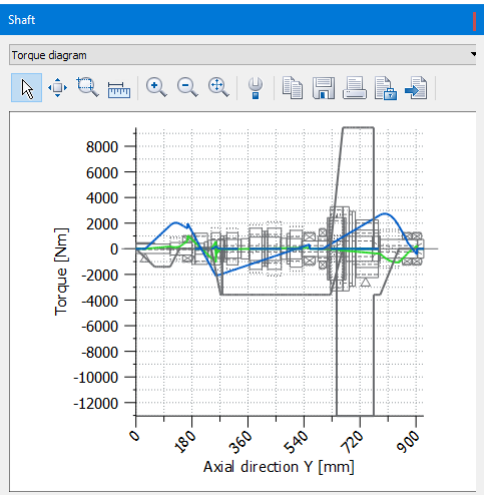
	Safeties		Results [%]	
	Fatigue	static	Fatigue	static
A-A	0.19	0.27	16.14	22.79
B-B	0.29	0.27	24.28	22.66
C-C	0.44	0.33	36.57	27.83
D-D	0.48	0.80	40.18	66.62
E-E	0.57	0.64	47.35	53.22
F-F	0.49	0.82	41.00	68.03
G-G	1.22	1.76	101.76	146.66
H-H	0.95	1.35	79.28	112.24
I-I	1.19	1.67	99.46	138.84
J-J	2.11	2.51	176.07	209.03

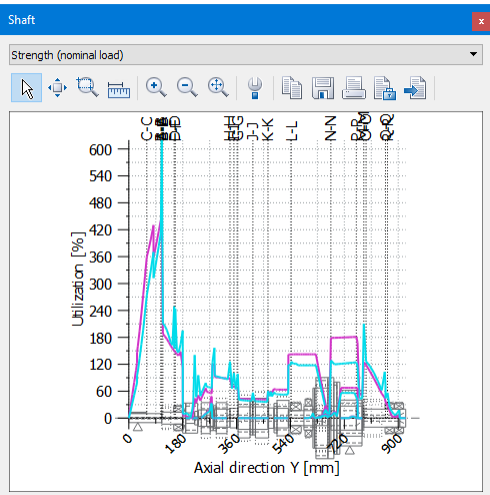
Resulting safety factors are reported for each cross section.

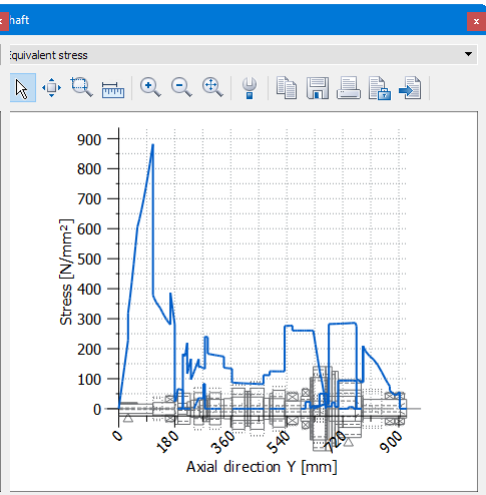
Static and fatigue safety factors, as well as utilizations are reported.

Results









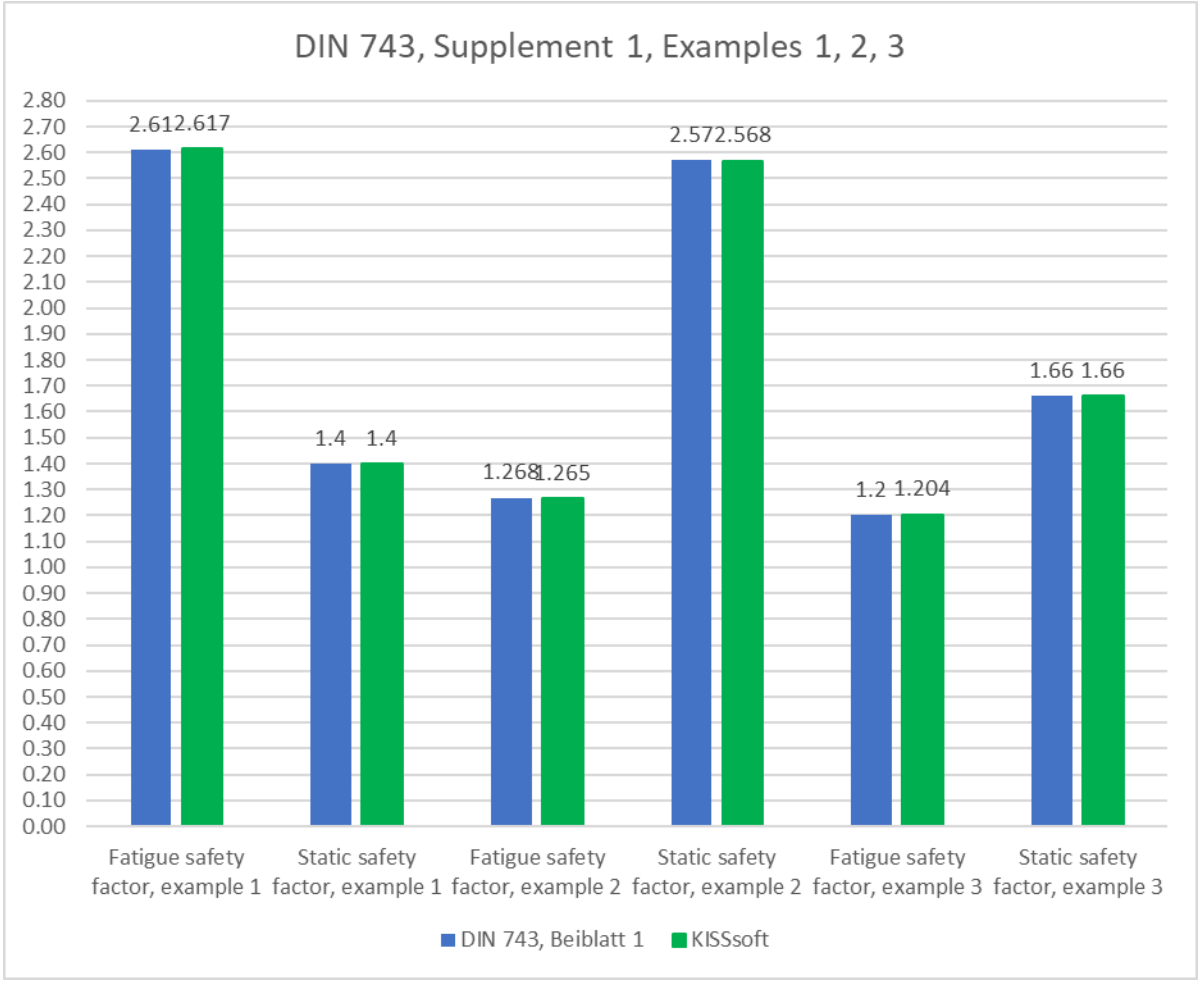
Resulting cross sectional forces and moments.

Resulting strength and stresses.

Example 1, 2, 3 from Supplement 1 to DIN 743

For all three examples, a match between KISSsoft and DIN is achieved.

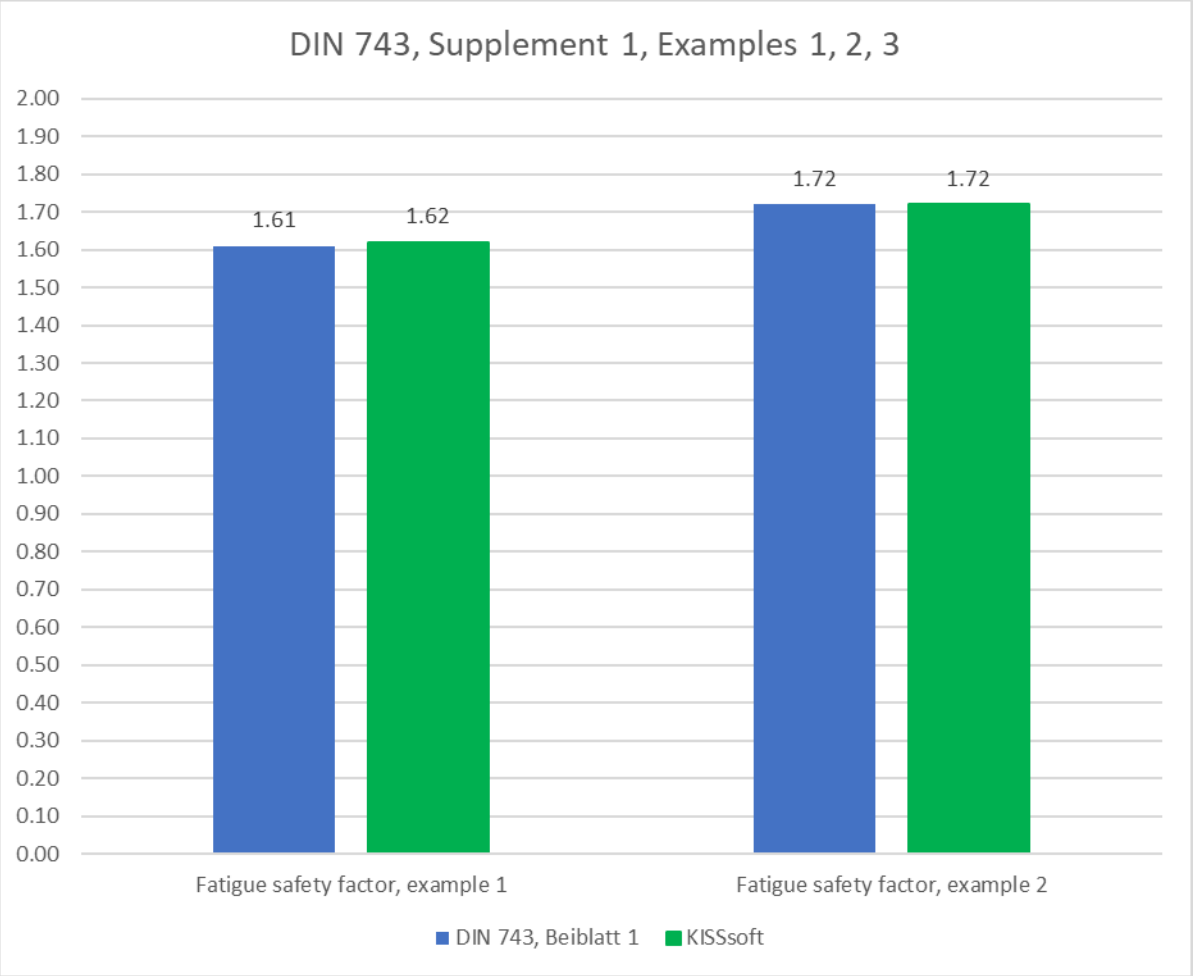
Minimal differences occur due to inconsistent use of rounding in DIN standard.



Example 1, 2 from Supplement 2 to DIN 743

For both examples, a match between KISSsoft and DIN is achieved.

Minimal differences occur due to inconsistent use of rounding in DIN standard.



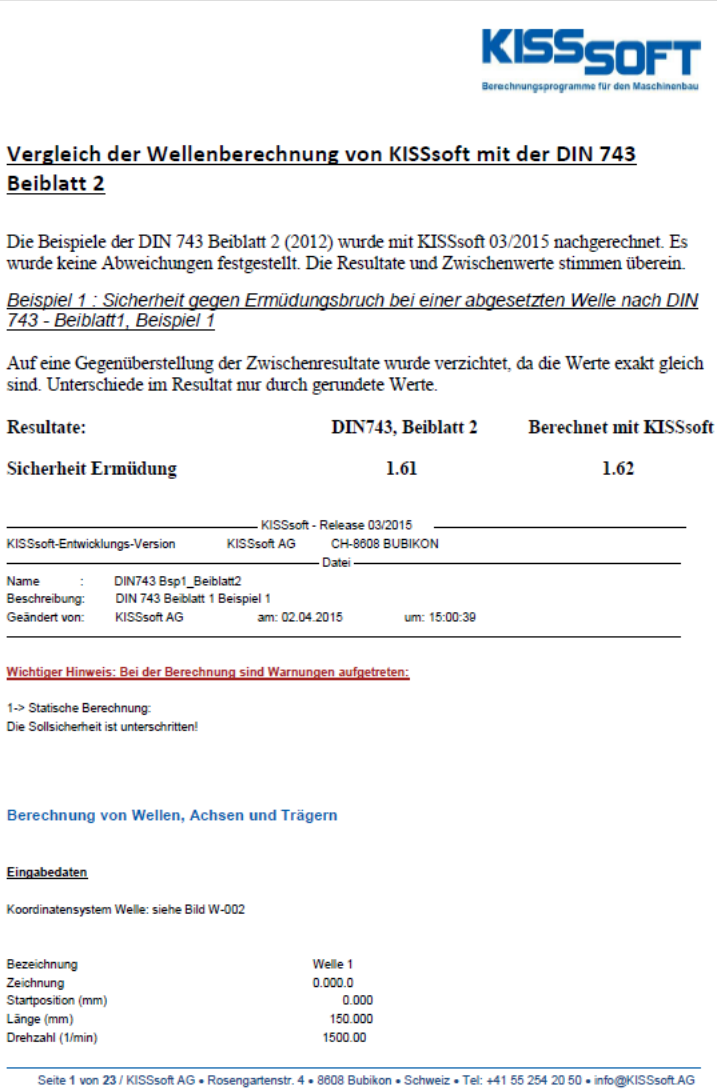
Verification

With the above five examples and countless companies comparing KISSsoft to their own calculation, sufficient verification has been delivered.

Experience shows that the most difficult part in shaft calculation is not so much the strength calculation but the cross-sectional forces. This for statically overdetermined systems where bearing operating clearance and bearing stiffness has a major impact.

From the above, we conclude that KISSsoft has implemented DIN 743 accurately.

Detailed calculation reports and files are available on request.



KISSsoft
Berechnungsprogramme für den Maschinenbau

Vergleich der Wellenberechnung von KISSsoft mit der DIN 743 Beiblatt 2

Die Beispiele der DIN 743 Beiblatt 2 (2012) wurde mit KISSsoft 03/2015 nachgerechnet. Es wurde keine Abweichungen festgestellt. Die Resultate und Zwischenwerte stimmen überein.

Beispiel 1 : Sicherheit gegen Ermüdungsbruch bei einer abgesetzten Welle nach DIN 743 - Beiblatt1, Beispiel 1

Auf eine Gegenüberstellung der Zwischenresultate wurde verzichtet, da die Werte exakt gleich sind. Unterschiede im Resultat nur durch gerundete Werte.

Resultate:	DIN743, Beiblatt 2	Berechnet mit KISSsoft
Sicherheit Ermüdung	1.61	1.62

KISSsoft - Release 03/2015
KISSsoft-Entwicklungs-Version KISSsoft AG CH-8608 BUBIKON

Datei
Name : DIN743 Bsp1_Beiblatt2
Beschreibung: DIN 743 Beiblatt 1 Beispiel 1
Geändert von: KISSsoft AG am: 02.04.2015 um: 15:00:39

Wichtiger Hinweis: Bei der Berechnung sind Warnungen aufgetreten:

1-> Statische Berechnung:
Die Sollsicherheit ist unterschritten!

Berechnung von Wellen, Achsen und Trägern

Eingabedaten

Koordinatensystem Welle: siehe Bild W-002

Bezeichnung	Welle 1
Zeichnung	0.000.0
Startposition (mm)	0.000
Länge (mm)	150.000
Drehzahl (1/min)	1500.00

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Tragfähigkeitsberechnung von Wellen und Achsen
Teil 1: Einführung, Grundlagen

DIN 743-1

ICS 21.120.10

Shafts and axles, calculation of load capacity – Part 1: General basis

Calcul de la capacité des arbres et axes – Partie 1: Base

Thank you for your attention!

Inhalt

Sharing Knowledge

KISSsoft AG, A Gleason Company
Rosengartenstrasse 4, 8608 Bubikon, Switzerland
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KISSsoft