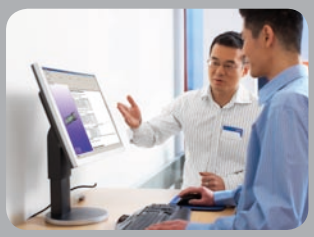
SKF Spindle Simulator

Advanced software for the analysis of spindle applications







SKF Spindle Simulator

Advanced spindle analysis software

SKF Spindle Simulator is an advanced simulation software program for the analysis of spindle applications. Based on the SKF Simulator platform and using the same advanced technology, it has been designed to be exceptionally user friendly.

The software makes allowance for the effect of the operating speed and temperature on the bearing shaft and housing fits and also the bearing preload. In addition, at each point in the spindle's duty cycle, it analyzes the effect of the external loads on the shaft and the bearings and delivers highly accurate information about each contact for each rolling element on each bearing.

SKF has combined SNFA and SKF's engineering knowledge and resulted in the development of this software program.

This program supports the analysis of spindles and contains detailed models of the new harmonized SKF-SNFA super-precision bearings.



Functionality

- All super-precision bearings
- Shaft deflection graphs
- Mounting analysis (preload, shaft and housing fits etc.)
- Input axial temperature distribution for shaft and housings (z-direction) in the 2D drawing area
- Lubrication and material database
- Gravity direction setting possible
- Expected fatigue life of the bearings
- Electric motor rotor component
- Speed limits

Benefits

- This software program combines engineering experience from SKF and SNFA.
- This program helps the building of spindle models in a fast and user friendly way.
- It includes all types of SKF-SNFA super-precision bearings (angular contact ball bearings, cylindrical roller bearings, double row cylindrical roller bearings and double direction angular contact thrust ball bearings).
- Based on the SKF Simulator platform and delivers highly accurate results.
- 3D animations show just how the spindle is operating.
- Report templates are available in the program and their export provides easy report generation.
- Clear self-explanatory documentation.
- The SKF Spindle Simulator makes an easy link between the user and SKF's engineering knowledge.

Features

Connecting to the SKF-SNFA bearing database

Connecting to the on-line SKF-SNFA bearing database ensures that tha data used is always current according to the production standard.

Super-precision bearings

All types of SKF-SNFA super-precision bearings are available in the database.

Material and lubricant database

Predefined materials and lubricants can be selected.

Grouping of bearings

A very user friendly way of grouping bearings enables the creation of preloaded bearing sets and fast modelling of your application.

Preload and axial clearance

Groups of bearings can be preloaded by rigid preload, spring preload or hydraulic preload. Also, axial clearance can be defined.

Standard preloads

The software includes the standard preload classes of the super-precision bearing series.

Special preloads

Where standard preloads do not meet the operating requirements, it is possible to define one that does.

Tolerance database

The tolerance database allows the selection of standard dimension tolerances in a fast and easy way. Specific tolerances can also be added.

Attainable speeds for oil-air and grease lubrication

This software program provides speed limits for bearings and sets of bearings according to the fits, spacing and operating conditions for both grease and air-oil lubrication.

Shaft design presented in the 2D assembly drawing area

The 2D drawing area gives a good overview of the shaft model and allows you to create your application model in a user friendly way.

Tables with important parameters

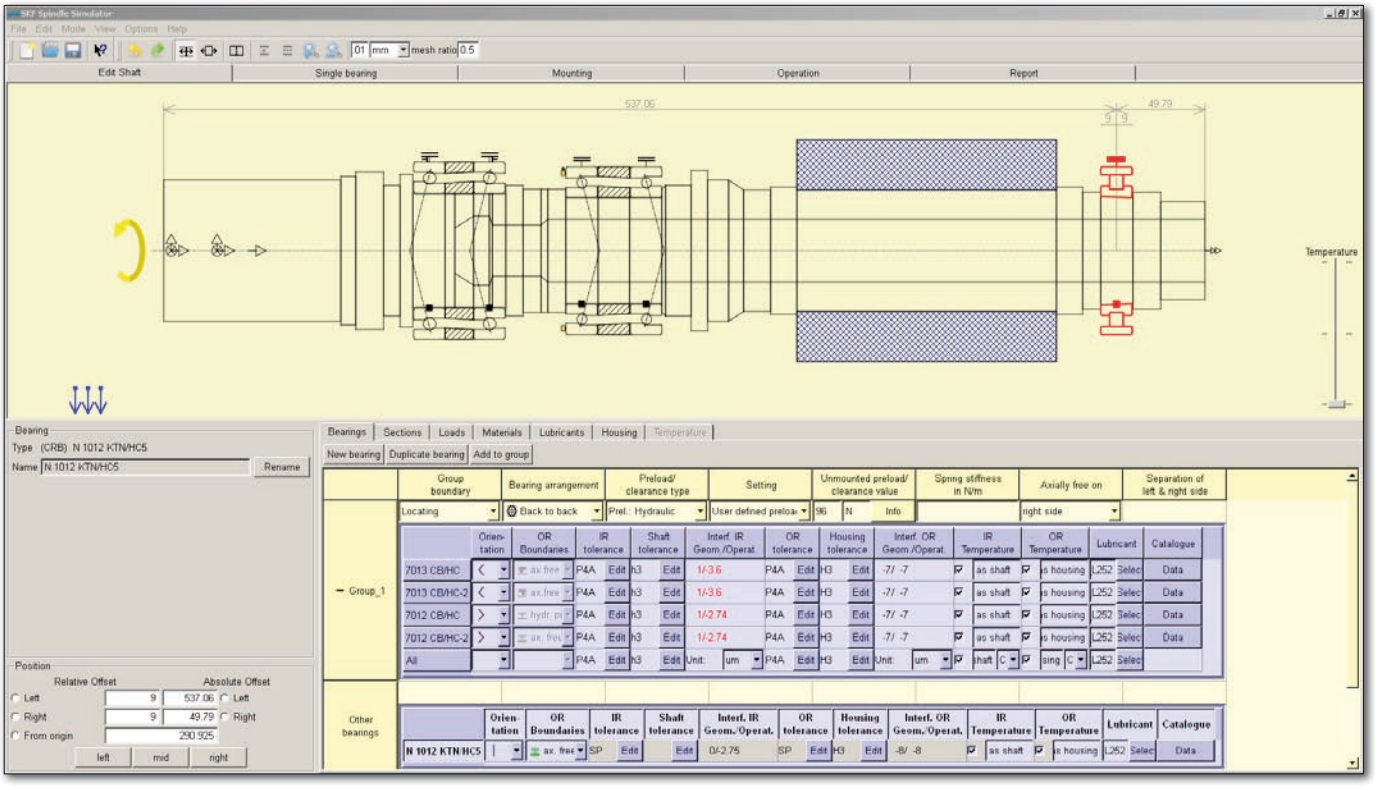
Tables with the important operating parameters of the bearings and the preloaded groups allow for a quick overview and easy modification of the model.

Spindle Inclination

Whether the spindle orientation is horizontal, vertical or inclined, the effect of the automatically calculated shaft weight is considered.

Electric motor rotor component

A component representing the rotor of an electric motor is available.



Input of axial temperature distribution for shaft and housing

The axial temperature distribution can be set for the shaft and the housing.

Single bearing calculation

The software allows you to perform a quick analysis of a single bearing from the complete model of bearing. Therefore, it accounts for temperature distribution with the system, different materials, preloads, different fits and clearances, and determines actual operating parameters as a function of shaft speed, shaft displacement or applied loads.

Mounting analysis

The mounting analysis looks at the static spindle and calculates the bearing contact parameters and preload at reference (build) temperature or at operating temperature. It accounts for the influence of the shaft and housing fits and the initial bearing set preload.

Operating analysis / Load cycle calculation

The operating analysis predicts the behaviour of the system during operation, including external forces, operating temperatures, preloads and rotational speed. In a load cycle calculation, the operating loads acting on the spindle and the rotational speeds can be varied in accordance with the points of the spindle's duty cycle.

3D animations of operating conditions

3D animations visualise the behaviour of the model during operation and give a better understanding of how the spindle will work.

Report templates

Report templates allow for a quick creation of a report.

Operating parameters

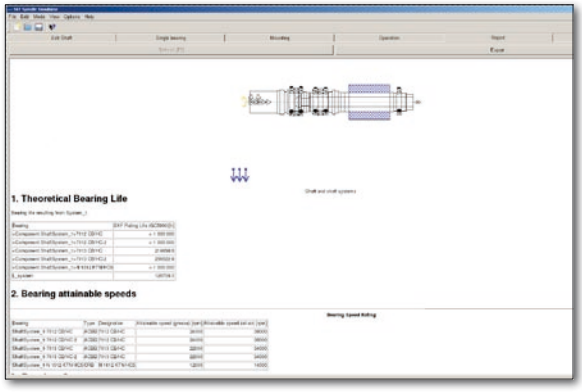
The report provides information about all relevant operating parameters, like contact stresses, contact angles, displacements, bearing loads, shaft displacements, etc.

Life calculation

The SKF Spindle Simulator provides a prediction of bearing life for each point in the load cycle and for the load cycle as a whole.

Elastic lines

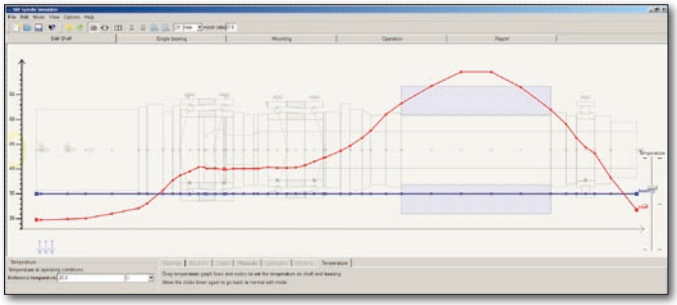
Graphs of the elastic lines visualise the deformation of the shaft.



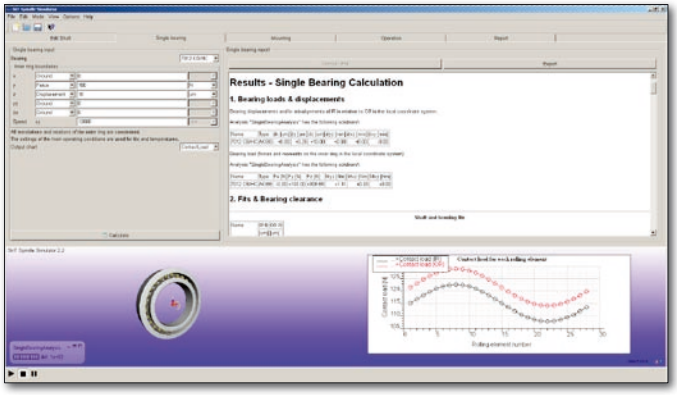
Report template

Help File

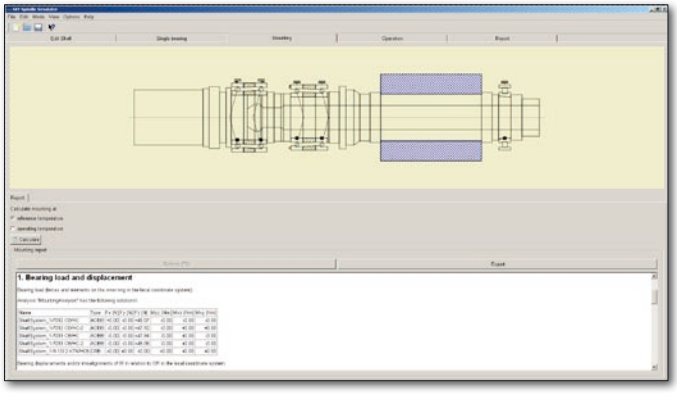
The comprehensive and easy to use Help file guides and supports you in using this powerful tool.



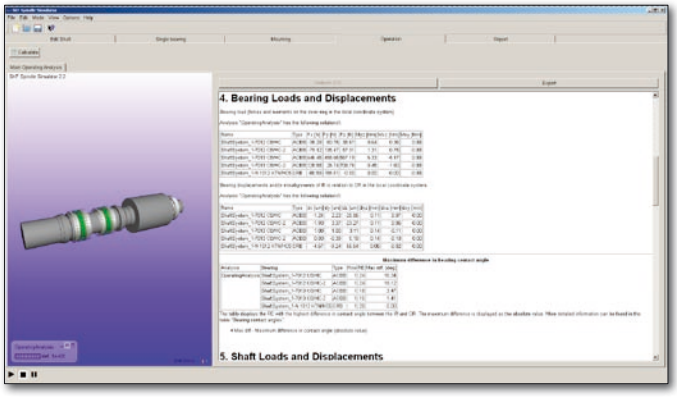
Axial temperature distribution



Single bearing calculation



Mounting analysis



Operating analysis/Load cycle calculation and 3D animation

SKF calculation tools

SKF possesses one of the most comprehensive and powerful sets of modelling and simulation packages in the bearing industry. They range from easy-to-use tools based on SKF General Catalogue formulae to the most sophisticated calculation and simulation systems, running on parallel computers.

The company's philosophy is to develop a range of programs to satisfy a number of customer requirements; from fairly simple design checks, through moderately complex investigations, to the most advanced simulations for bearing and machine design. Wherever possible, these programs are available for in-the-field use on customers' or SKF engineers' laptops, desktop computers or workstations. Moreover, particular care is taken to provide integration and interoperability of the different systems with each other.

SKF Interactive Engineering Catalogue

The SKF Interactive Engineering Catalogue is an easy-to-use tool for bearing selection and calculation. Bearing searches are available based on designation, dimensions, design and performance. Several calculation programs are available.

This catalogue also enables the generation of CAD drawings that can be imported into customer application drawings developed with the major CAD commercial packages.

The SKF Interactive Engineering Catalogue also contains, in addition to the complete range of rolling bearings, catalogues covering bearing units, bearing housings, plain bearings and seals.

SKF Bearing Beacon

SKF bearing beacon is the mainstream bearing application program used by SKF engineers to find the best solution for customers' bearing arrangements. SKF bearing beacon is based on the SKF Simulator platform, and will be renamed SKF Application Simulator with the next main release. The technology allows the modelling in a 3D graphic environment of flexible systems incorporating customer components. SKF bearing beacon combines the ability to model generic mechanical systems using shafts, gears, housings, etc. with a precise bearing model for an in-depth analysis of the system behaviour in a virtual environment. Furthermore, SKF bearing beacon can perform advanced bearing rolling fatigue evaluations. SKF bearing beacon is the result of several years of specific research and development within SKF.

Orpheus

The numerical tool Orpheus allows for studying and optimizing the dynamic behaviour of noise and vibration critical bearing applications (e.g. electric motors, gearboxes). Orpheus is based on the SKF Simulator platform, and will be renamed SKF Advanced Simulator with its next main release. It can be used to solve the complete set of non-linear equations of motion of a set of bearings and their surrounding components, including gears, shafts and housings. It can provide an in-depth understanding of and advice on the dynamic behaviour of an application, including the bearings, accounting for form deviations (waviness) and mounting errors (misalignment). This enables SKF engineers to determine the most suitable bearing type and size as well as the corresponding mounting and pre-load conditions for a given application.

Beast

Beast is a simulation program that enables SKF engineers to simulate the detailed dynamics inside a bearing. It can be seen as a virtual test rig performing detailed studies of forces, moments etc. inside a bearing under virtually any load condition. This enables the "testing" of new concepts and designs in a shorter time and with more information gained when compared with traditional physical testing.

Other programs

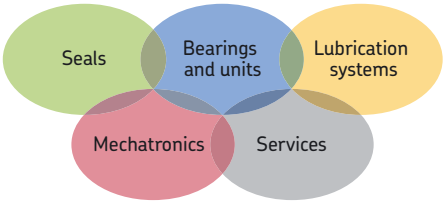
In addition to the above-mentioned programs, SKF has developed dedicated computer programs that enable SKF scientists to provide customers with bearings having an optimized bearing surface finish to extend bearing life under severe operating conditions. These programs can calculate the lubricant film thickness in elasto-hydrodynamically lubricated contacts. In addition, the local film thickness resulting from the deformation of the three dimensional surface topography inside such contacts is calculated in detail and the consequent reduction of bearing fatigue life.

In order to complete the necessary capabilities of their tasks, SKF engineers use commercial software packages to perform analyses such as finite element or generic system dynamics analyses. These tools are integrated with the SKF proprietary systems, enabling a faster and more robust connection with customer data and models









The Power of Knowledge Engineering

Drawing on five areas of competence and application-specific expertise amassed over more than 100 years, SKF brings innovative solutions to OEMs and production facilities in every major industry worldwide. These five competence areas include bearings and units, seals, lubrication systems, mechatronics (combining mechanics and electronics into intelligent systems), and a wide range of services, from 3-D computer modelling to advanced condition monitoring and reliability and asset management systems. A global presence provides SKF customers uniform quality standards and worldwide product availability.

® SKF and SNFA are registered trademarks of the SKF Group

© SKF Group 2009
The contents of this publication are the copyright of the publisher and may not be reproduced (even extracts) unless prior written permission is granted. Every care has been taken to ensure the accuracy of the information contained in this publication but no liability can be accepted for any loss or damage whether direct, indirect or consequential arising out of the use of the information contained herein.

PUB BU/P9 10167 EN · September 2009

Printed in Sweden on environmentally friendly paper.