

All for One, One for All

Collaboration Moves Bearing Modeling and Simulation Software Forward

Matthew Jaster, Senior Editor

Software is a rather unique beast in the power transmission market. Between all the updates, new technology and user feedback, it's about as fluid a product as you're going to get. Collaboration between software providers and users is imperative. The challenge is creating user-friendly software tools that work for large corporations to small job shops and everything in-between. You have to be technical enough to keep up with the latest trends and conventional enough to keep each and every client happy.

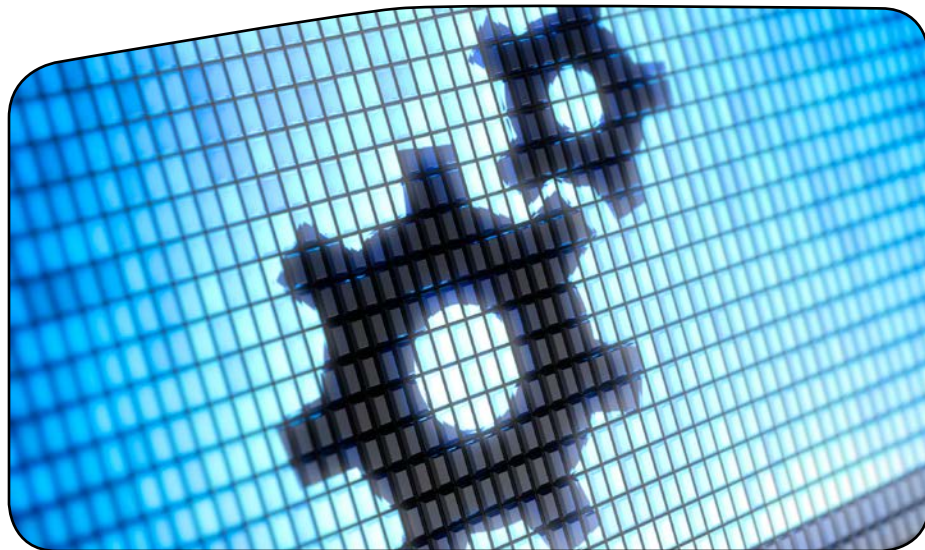
"Customers want bearing modeling and simulation software to help prevent them from making the mistakes that we see coming," says Mark Martens, manager of application analysis systems at Timken. "The way they access this information is one of the greatest challenges. Whether it's online, offline, by computer, smartphone or tablet, there's a lot of neat things you can do with connected technology today."

"There is a constant flow of requests and a continuous exchange of information between the development team and the users," says Andrea Bacchetto, team leader, knowledge and simulation tools at SKF. "Releases are scheduled twice a year to follow-up on the users' feedback and also to prepare the new breakthrough versions."

Addressing the individual needs of each customer is the most essential part of the process.

"You might have a student looking for some bearings for a Baja car or an engineer that needs information for a large industrial gearbox. Each client has different needs and we want to make sure they come to the right answer along the way," Martens adds.

"It is recognized that the software tools are becoming more and more a commodity: customer knowledge levels are growing and also their needs. Even a small size business is nowadays



using software tools to predict performance," Bacchetto says.

Timken offers two groups of programs in this area: a comprehensive set of engineering tools available at www.timken.com including bearing analysis, bearings searches, 2-D drawings and 3-D models as well as a larger software suite of internal tools.

SKF develops internal software platforms which are distributed on a global scale. Users of such tools include application engineers, researchers and product developers. "SKF simulation software tools are used on a daily basis to support internal development as well as to answer questions from customers via application engineers and handle single bearings up to complete systems of multiple shafts, gears and bearings," Bacchetto says. "Beside the internal offerings, SKF has released an outside SKF Spindle Simulator which is based on one of the internal software platforms as well as more basic tools to support customers with various bearing selection aspects as well as sealing and lubricant selection. Also CAD models are available at www.skf.com."

In order to enhance reliability and maintenance of its products, Timken makes sure the modeling and simulation software keeps up with the selec-

tion or manufacturing process. "You have to be much more proactive," Martens says. "We can't really stop at just tools. We have to also help our customers realize the optimal performance of our bearings. It's not just the sale of a part in a box. It's also the information and service engineering support to help folks make good choices about their lubrication, sealing and shop practices. All these things go together to achieve that."

One way to ensure reliability is to make sure the customer is properly trained and instructed on how to best utilize the software tools. Customer training is a priority that



SKF Simulator Software

must be met and continually pursued as new updates and technologies are introduced.

"We don't want to hand out sharp knives without safety instructions," Martens says. "We also don't want to push out our tools without proper guidance or training. This is why we encourage our customers to come back to talk to our engineers and help them through each step."

Timken offers a range of onsite and local training courses that are customized to individual industries. "The long-term goal, of course, is to have our customers better educated on our products and the software tools that are available to them," Martens adds.

SKF currently has 21 Solution Factories across the globe and hopes to have 50 total Solution Factories in the next three to four years. An operation like this allows SKF engineers to be near their customers based on the specific industrial needs of the area. Here, an SKF expert can provide the knowledge and services necessary to design and create custom solutions on top of training.

When face-to-face training or travel is out of the question, the user experience online plays a pivotal role.

"Our customers want to work in an environment they're comfortable with. They don't want to change for us. They want us to come to them," Martens says. "When you see the CAD models on our website, you will find we offer 20 file types for download, and direct import into another 33 specific CAD systems. Anytime a user has to take your data and convert it into something that works for them, that's an extra obstacle.

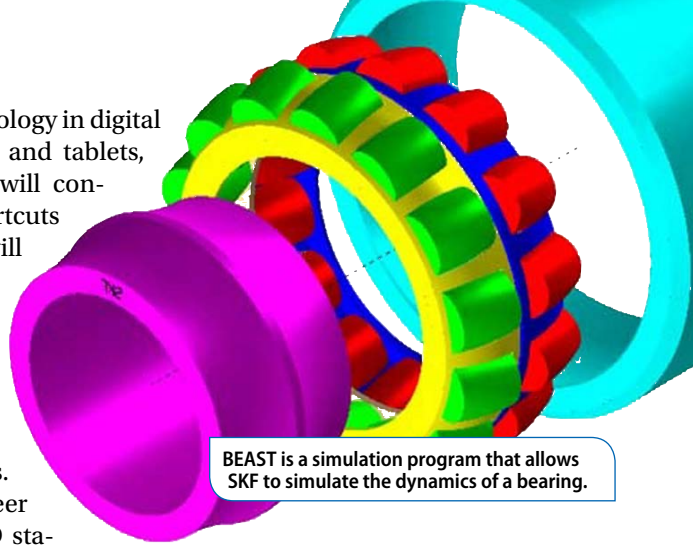
This takes time. We'd want to provide things in as consumable a format as possible."

SKF presented their cloud service

at Hannover Fair in Germany last year. The service can be used to collect data regarding the status of bearings in a machine. "The SKF cloud system is explained in the first issue of *Evolution* in 2014 (<http://evolution.skf.com/in-the-cloud>)," says Bacchetta.

With advancing technology in digital cameras, smart phones and tablets, bearing software tools will continue to offer new shortcuts and technology that will change how troubleshooting is addressed on the shop floor.

There are two distinct groups that utilize Timken's software tools, according to Martens. "For the design engineer that's working at a CAD sta-



BEAST is a simulation program that allows SKF to simulate the dynamics of a bearing.



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Spherical bearings are designed to manage high radial loads even when misalignment, poor lubrication, contamination, extreme speeds or critical application stresses are present.

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Timken eliminates as many online obstacles to provide as consumable a format as possible.

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tion, there's very little value in creating a smart phone app to do heavy engineering. But if you think about the guy working on machinery that might need to get more information to grind a bearing seat, shaft or housing diameter, mobile tools make more sense. You don't want to stop and find a computer to do that."

"We are definitely targeting mobile devices for the next few years. SKF already has a heavy presence in the App Store and in Google Play. Advanced calculations are currently based on laptops and/or desktops, but thanks to increasing calculation power from the mobile devices, SKF will soon be in the position to port more advanced tools in such devices," says Bacchetto.

And what other improvements will be made to modeling and simulation software in the future?

"Things are becoming much more sophisticated," Martens says. "If you look at Finite Element Analysis (FEA), 10 or 20 years ago it was special, now it's an integral part of what we do. As our customers design closer to reliability limits, you have to consider not only the bearing but the environment and the application that it is in. I really think we'll see specialty cases becoming more and more routine."

The software solutions, however, can only take you so far. "Technology can't solve everything. There's no sub-

stitute for good experience and good engineers and I'm quite proud of those that we have at Timken," Martens adds.

SKF continues to see radical advancements to its software tools and believes there's much more to come. "64-bit capabilities, new report engines, speed improvements, FEM calculation dedicated to seals and large models, e.g. wind turbines," says Bacchetto.

The end result is to not only make products last longer through new technology, but make sure each component reaches its highest level of performance.

While this particular article focuses on bearings, Martens believes the whole PT system should be examined. "Any given component including the gears, bearings, housing, shafts, lubrication, etc, should be considered. None of those components rise or fall on their own or succeed without the others. By

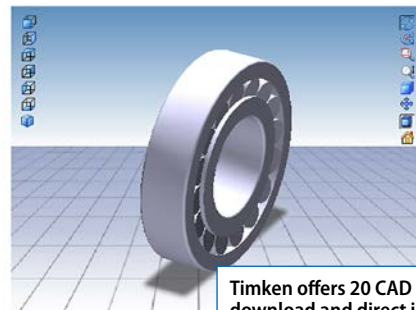
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Timken offers 20 CAD Models for download and direct import into another 33 specific CAD systems.

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2D Drawing

understanding the interaction and the contribution of each component to the system, I think that's where successful design comes into play."

For more information:

SKF USA Inc.
Phone: (267) 436-6000
www.skf.com

The Timken Company
Phone: (330) 438-3000
www.timken.com

Software Bits

In addition to SKF and Timken, there are several other companies that offer an array of software tools for bearing modeling and simulation. This sidebar provides a quick analysis of some of the other options on the market from the likes of Romax, MSC, Schaeffler and COBRA.

Romax Technology

From increasing durability in on-road applications to increasing bearing reliability in wind turbine technology, Romax provides support and advice on bearing selection, fitment, analysis and recommendation. Romax software can help users predict bearing life and durability, improve bearing selection, analyze bearing failure and assess and select suppliers. Additionally, *Romax-Designer* contains a comprehensive catalog of production bearings and allows customers to define any custom bearing including conceptual designs.

For more information:

Romax Technology
Phone: +(44) 0 115 951 8800
www.romaxtech.com

MSC Software Adams/Machinery

This module is for engineers who need to predict the impact of the design and behavior of rolling-element bearings on overall system performance. This includes an accurate representation of the bearing stiffness, sensitive to internal dimensions, offsets, misalignments, and clearances.

Customers can choose from 14 different rolling-element bearing types; look up bearing parameter values from a library of over 24,000 off-the-shelf bearings and/or input values directly; calculate bearing reaction forces, optionally leveraging a nonlinear stiffness response from embedded tech-

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Schaeffler INA/FAG Brands

Along with the supply of top quality machine elements matched to customer applications, good service is an important tradition at INA and FAG. Rolling bearing design is one of the focal points of design support. An important task there is to ensure that the product is designed correctly to give customers the competitive edge. To meet this requirement, INA and FAG have been using calculation programs successfully for more than 30 years. *BEARINX*

software is a program for performing rolling bearing calculations. It enables rolling bearing supports to be analyzed in detail – from single bearings to complex gear systems and linear guide systems. All calculations are performed in a consistent calculation model. Even for complex gears, the contact pressure on each rolling element is considered in the calculation.

For more information:

Schaeffler Technologies
Phone: +(49) 91 32 82-0
www.schaeffler.com

Cobra Software Family J.V. Poplawski & Associates

Cobra-EHL is an entry-level software package designed for the mechanical designer/engineer. *Cobra-EHL* analyzes the interaction of up to six bearing rows on a rigid shaft under combined radial, thrust, and moment loading in three degrees of freedom. The program has a visual front end that allows the user to interactively change input data and preview results without having to exit the program. Lubricant film thickness and associated life adjustment factors are internally computed.

Cobra-AHS analyzes up to five bearing rows on a flexible or rigid shaft loaded in five degrees of freedom. Bearing models include high-speed ball, cylindrical roller and tapered roller bearings. Housing and shaft distortion effects due to out-of-round, out-of-flat and local slope at each rolling element are included. Bearing heat generation and cage forces are calculated. Roller edge stress concentration is calculated due to local roller misalignment for crowned rollers and displayed as a 3-D color contour plot. Bearing fit-up analysis is performed using classical thick ring press fit theory as well as a seamless interface to *ANSYS FEA* models of the bearing row that are automatically constructed and analyzed with results returned to *Cobra*.

For more information:

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