Gear Design Software

An Ongoing Exercise in Learning

Matthew Jaster, Associate Editor

For five days, sun up to sun down, Romax Technology hosts a comprehensive software training seminar at their location in Troy, Michigan. Attendees are politely asked to shut down their cell phones (unless the world is ending) and focus on the information that is being presented. These work sessions typically go through lunch and sometimes even carry on during dinner. "Even the sharpest minds leave the training session with more questions than answers," says Miland Dange, general manager at Romax. "There is so much information presented that the mind is racing. This is why it's *so important* to have a comprehensive training program as well as a high tech support system." Engineers that have worked with gear software can tell you with confidence that the complexity of it can be daunting, particularly when trying to understand not only what can be done with the software, but the steps needed to achieve it.

The truth is there is no shortage of gear design software packages. Some have enhanced features, global market appeal, user-friendly interfaces or specific areas of expertise. Others simply cost less than the competition. Every company, large and small, believes that the support and training element is just as important as the original purchase of the software itself. In reality, it's probably more important.

Software Support & Training

Twenty years ago, it may have taken a gear engineer weeks to complete a computer model. Many of the software programs today can complete the same task in a few days. "It used to be that you could wow a potential customer with the software capabilities alone," says Dange at Romax. "In today's market, people really pay attention to comparing tools and figuring out how much money and time they can save. Since the software is so dynamic, it's important to visit your customers regularly and make sure they're getting the most out of the various features and capabilities."

"An important part of successfully using any software program is ensuring that the user fully understands how the program works," says Gunther Weser, manager at GWJ Technology GmbH.

"By attending our workshops, the user can benefit from the knowledge of our qualified engineers. Customers can gain a deeper understanding of basic skills, design strategies or optimizations of machine elements."

"Customers are interested in specific and focused training. For example: if they are making power tools then they want training regarding how best to design and or manufacture gears used in power tools. Or how to manufacture plastic gears, etc. They want very targeted rather than generic training," says S.M. "Jack" Marathe, president and CEO of UTS. "The issue is not as much about learning how to use to software. Instead it is about trying out many different scenarios and thus developing a good insight about which factors affect a design and by how much. In such cases a well-designed software package helps in speeding up the process. That is the approach UTS has always taken, and we have found that the customers like such an approach."

"Detailed product training and theory is essential to the correct use of our product, so in our training courses we would introduce specific examples possibly provided by the customer which demonstrate why the software is required," says Mike Fish, co-director of Dontyne Systems Limited. "We offer courses based on our own product capability. We identify why the software is necessary rather than simply which buttons to press. We have different modules to look at different aspects of production but we try to demonstrate how effective it is to link several modules together directly. This more accurately models real world situations as the stages are effectively linked."

Stefan Beermann, CEO at KISSsoft AG, says that the scope of the training is usually not just the software but must also cover the machine design aspects related to it. "This means the implemented methods, strategies for optimization, typical errors and known problems in the application are also covered," Beerman says.

This 24/7 training and support system can be accomplished in many different ways. While some software suppliers prefer sending representatives onsite to assist with troubleshooting, others prefer webinars, video conferencing or e-mail.
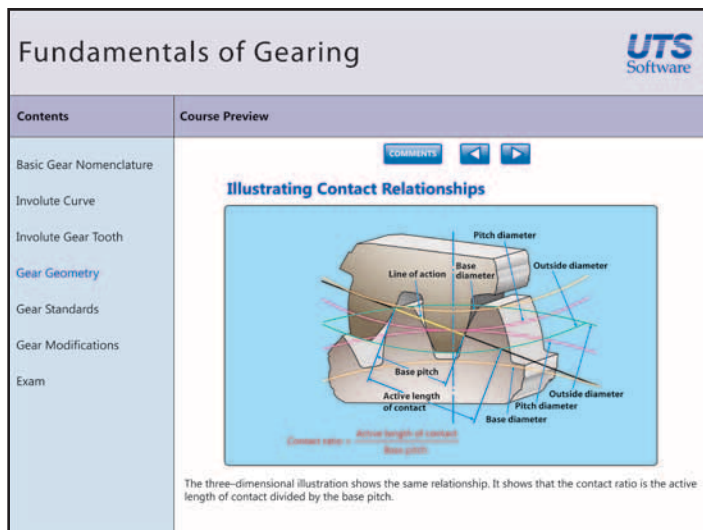
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"Most of the training is face-to-face. Webinars are done in an increasing number, but they will never replace the face-to-face trainings completely. This is comparable in using the telephone instead of visiting someone. Most often conversation is done via phone or e-mail, but still we meet in person frequently," Beermann says. "Recently we are conducting scientific conferences and user meetings as well. This way we can address a larger number of users in one place, making the communication more efficient."

"I would say that it is becoming easier to arrange Internet training. It is more flexible for both parties as it could be re-arranged at short notice and much lower cost. We would use local support to follow up during the year. We would prefer to avoid an on-site training session as it takes much greater time and money, but it is always possible," Fish adds.

"Having said that, it is also important to make sure the customer is comfortable with the support organization and availability of support to them. This includes things like time differences and language differences. For these reasons we have expanded our online training and demo capability, as well as our direct support organization. We have recently opened a U.S. support office and now provide support personnel around the world—Europe, Japan, Australia and the United States," says Rich Easley, North American business development manager for Dontyne.

Marathe at UTS believes a well-designed intuitive software package is preferred over just adding bells and whistles to an existing program.

"E-mails and voicemails are not practical solutions in our line of work," Marathe adds. "Prompt and insightful response to the questions raised by the customers is very important to keep the customer happy, and that is the strategy UTS has used since 1984."

"Gear engineers should first attempt to resolve problems themselves. If a resolution is not possible, the engineer can contact us," Weser says. "We use online solutions in order to support the user and to hold interactive meetings if the user has any questions or needs help to resolve specific design problems."

For Dange at Romax, it comes back to the importance of training sessions. "We conduct performance audits onsite with our customers to verify that they are getting the most they can from our codes, but we can't stress enough the importance of attending a five-day course with us where the focus is on the software itself. As dedicated as our customers are, sometimes they will not let go of their problems on the manufacturing floor. This means that they're frequently called away from training or support sessions or end up leaving the training altogether. It's important that each and every customer is engaged and ready to solve each problem."

Which Came First—the Software or the Gear Engineer?

A shortage in basic gear design skills contributes significantly to problems if the gear engineer uses the software as a crutch. Beermann at KISSsoft believes there will always be engineers that use gear software without the appropriate knowledge, hoping that the software magically compensates for their lack of experience.

"This is no different from computer natives using the automatic spell checker on their text processor instead of learning spelling and grammar," Beermann says. "On a higher level, gear software can be the right means to achieve gear specific knowledge. Even gear experts do not follow every change in the standards anymore, delegating

the knowledge about the formulae to the software. Also consistency checks can be done by the software, relieving the engineer from thinking about every little detail."

"Gearing is not taught much in engineering colleges. The extent of training may involve two weeks out of a 14 week semester course in machine design in the third year engineering curriculum and may be the same amount in the final year. That is about it! Hence when engineers enter the workplace, if their job involves designing or manufacturing gears, then it pretty much involves using the software that they have access to and hope for the best," says Marathe at UTS.

"It is possible to become *too* reliant on the software. Despite testing and various checks coded into software it is possible to generate errors by incorrect input for example," adds Fish at Dontyne. "It is essential for engineers to recognize a mistake in the data entry or results. During training it would be beneficial to introduce examples with wrong answers to see how many participants flag it and how many let it go."

"In principle, the basic knowledge should come from the universities. Unfortunately, machine elements are no longer a hot topic, so most universities reduce the amount of gear know-how provided. To compensate the gear engineer can attend one of the AGMA courses which are all conducted by real experts. (Especially, the courses of Robert Errichello and Ray Drago which will be a good basis as far as gear design is concerned). We also offer training that covers relevant topics. Still, most important is doing it yourself, learning on the fly. This includes discussions with experts and gaining knowledge by experience. Gear design is not complicated in detail; it is only the huge amount of details that take time to learn," Beermann says.

"At the end of the day, it comes down to hands-on experience," adds Dange at Romax. "Unless you have an opportunity to mess around with the hardware and really spend some time on Gear Engineering 101, you won't be there quite yet. The Gear Lab at Ohio State is one example of a university that offers fantastic basic gear design courses. We pride ourselves at Romax with hiring gear engineers with real world experience, it's important that they can relate to the problems our customers face."

"Gear engineers have the necessary technical background but the demands mean not only good basic knowledge but also ongoing continuous training to keep pace with all the new developments in gear design," says Weser at GWJ Technology. "The engineers have the knowledge to use our *eAssistant* or *GearEngineer* software, but if specific design problems occur, a deeper knowledge is needed to resolve the problems. The software does most of the work but the users should not rely solely on software."

Maintenance & Upkeep

Another key aspect of support is software updates and maintenance. Every company interviewed for this article strongly believes that keeping up with customer requests and feedback is essential to long-term success.

"Permanent maintenance is a decisive factor for software products. To keep our customers and to fulfill their needs, it is important to update our software tools regularly. Many helpful suggestions by the users support the development process. We recently released a new software product, the *eAssistant SystemManager* which enables the user to create complex shaft systems. First feedback received from our users and clients was positive with regards to operational ease and flexibility," Weser says.

"We currently have a frequency of one new release per year. After nearly 35 years of development most of the changes with a new release are very specific and detailed. Still, each release contains one or two larger new highlights, as for instance the contact analysis for a planetary system in the current new release. Patches are provided whenever appropriate, as soon as an issue is found and fixed. These patches are available for free via download from our website," Beermann says.

Attendees of KISSsoft's Swiss Machineelements Colloquium 2012 learn about the latest software updates and products.

"We produce major releases every 1-2 years but our *Gear Production Suite* is evolving so quickly we tend to put 2-3 minor releases out each year. This allows us to insert customer requested functions and other changes from feedback from our customers on a regular basis. Because our distribution is downloaded, in many cases we can update a customer immediately if a specific function has been requested," Fish says.

"We keep a product requirement list and when we have significant market input, we act on it. The road map is very dynamic. It's constantly monitored. While these have been sporadic in the past, we now have a cadence of releases, something exciting coming out on a regular basis," Dange says.

UTS keeps up with customer requests for updates but is mindful that too many changes can sometimes cause confusion. "There needs to be a balance in how often software

updates are released. Customers actually do not like too many updates unless such updates are really necessary to keep pace with the changes in platforms like the operating system," Marathe says.
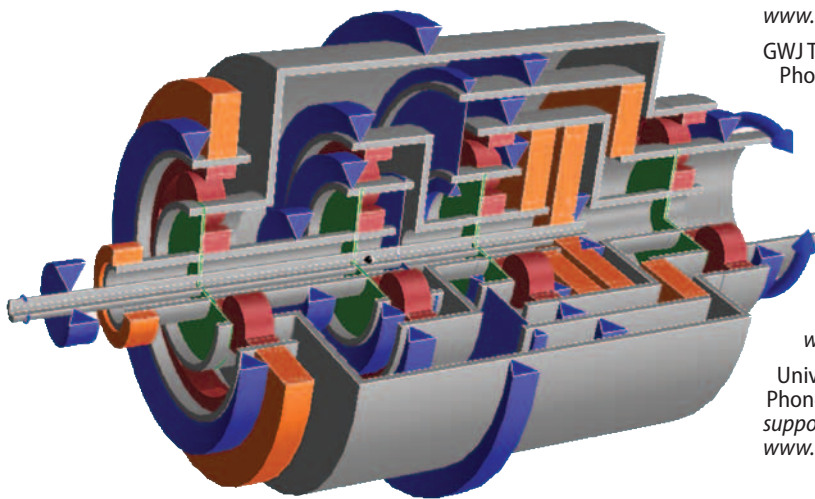
Getting Your Money's Worth

Gear design software is evolving like the rest of the software industry and the main objective for KISSsoft, Romax, GWJ, UTS and Dontyne is to keep up with the ever-changing requirements of the customers.

"With a software as comprehensive as *KISSsoft*, even the experts will have questions frequently, only on a higher level. So the support is treated as part of the product," Beermann says. "The management should allow time for learning. Often the expectation is that after the purchase of gear software, the engineers can solve every problem immediately. This will not work. The engineers will need some extra time for getting used to the software."

"The pace of technological development is incredibly quick and with the growing popularity of smartphones and tablets, mobile technology is becoming an increasingly interesting part. There are also demands for parallelization of processes (processes that are allowed to run simultaneously), providing much more efficient calculation and in order to work faster and execute more complex tasks," Weser says. "It is also observed that the processes of calculation, design and manufacturing are tightly linked together. Our national and international collaborations are growing significantly. Several colleagues worldwide are now actively involved in certain projects."

"Making the software more intuitive and doing as much handholding as possible to guide the customer to creating prudent designs is what the customers are looking for. Adding more bells and whistles is far from what the real serious customers want. The other trend is more industry specific software modules. More vertical, the better," adds Marathe.

"I think regular communication is still the key. This should be used to establish the current usage. If a customer has purchased a

Training seminars like GWJ's Fundamentals of Bevel Gear Design lets participants focus on bevel gears, tooth design parameters and manufacturing processes.

product but does not fully understand how to make it perform after the initial training it is essential for them to say so or for the supplier to determine it," Fish says. "The software may become less and less used and revert to old methods. While probably still effective, they may well not be as quick or as safe as using the software, which is a key aspect of modern design."

"The young engineer will never even think about not using a computer for his work. So the discussion, 'Why should someone use a computer program to calculate a gear?' came to an end," says Beermann. "On the other hand, the number of engineers that need a computer to calculate the reference diameter for a spur gear is increasing. So in the future, we will have to discuss why it is necessary to be able to do these calculations with mental arithmetic. Computer natives are more willing to accept flaws in software; however, there is a danger that many of them do not have a healthy suspicion about results from a computer and the gut feeling if something is lost." **PTE**

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