

The “Gear Gods” Help Those That Help Themselves

AGMA delivers with online and on-demand gear training

By Jack McGuinn, Senior Editor

(Editors’ Note: With the following article *Gear Technology* begins its enhanced coverage of gear training and education programs. From teens to twenty-somethings to bucket-listers—gearing/engineering programs around the country are fighting the good fight in their efforts to coach up both aspiring and veteran gearheads. Watch this space in every issue as we showcase these schools and associations.)

It makes sense to begin our newly expanded coverage of education with the American Gear Manufacturers Association’s (AGMA) longtime commitment to the industry and its members via their comprehensive gear schools and an assortment of on-demand or real-time, face-to-face seminars on specific gear issues. In all cases the classes and seminars—onsite, online, video format—are taught by veteran gear industry players; i.e., gear business owners, OEM executives, highly talented engineers, full-time educators and CEOs among them.

To obtain the most up-to-date information regarding all AGMA training we turned to Jan Alfieri, AGMA education manager.

“We have a number of great online training opportunities that run the gamut: from 90-minute webinars to 15-hour video courses offered in one-hour segments,” Alfieri says. “The webinars are offered live throughout the year and are then archived for purchase later if you missed one. Many companies encourage employees to attend the live sessions as a group, and they also purchase the archived event for a company training library.

“Through generous support from the AGMA Foundation, we have recorded two of our most popular live courses, taught by two of our most revered gear experts—*Detailed Gear Design*, taught by Ray Drago, P.E. (gear-doc@att.net), and *Gear Failure Analysis*, taught by Bob Errichello (geartech@mt.net). Students can get the experience of the course through one-hour-segment videos and supporting training documents.

“We also offer three self-paced courses that are free to employees of member companies (a savings of \$295 per person, per course.) These begin with *Fundamentals of Gearing* (which provides a nice foundation for anyone in a company) and then become a bit more advanced with (*Gear Manufacturing Hobbing and Parallel Gear Inspection*.)”

It is obvious in visiting the AGMA website (www.agma.org) that there is no shortage of training modules and seminars available—for AGMA members and non-members—there for the “taking” whenever you’re ready and class schedules allow. We’ll focus here on just a sampling—some new—of the many learning opportunities.

Arguably the most significant news regarding AGMA’s gear school is that two of the most popular—and important—classes offered are now available both online and in video format. We’re talking about Drago’s *Detailed Gear Design* and Errichello’s *Gear Failure Analysis*. If you went through the college experience you can liken the keen interest in these courses and their teachers to those presented by revered professors teaching, for example, Film 101 or *The Kinsey Report*. And so it is there is always a waiting list to sign up for *Gear Failure Analysis* (Ed’s note: See page 84 for information on Ray Drago’s *Gearbox CSI* event in March).

Gear Failure Analysis

Errichello employs the latest industry tools and methods; i.e.—lectures, slide presentations and Q&A sessions—to impart a straightforward yet comprehensive understanding of why gears fail. Errichello possesses Bachelor’s and Master’s Degrees in mechanical engineering and a Master of Engineering degree in structural dynamics. He has over 40 years of experience, has authored some 60 articles—many appearing in *Gear Technology*—and is a recipient of AGMA’s prestigious Lifetime Achievement Award.

According to Errichello, students will learn the causes of gear failure and how to proactively prevent it. (Avoiding gear failure can save tens of thousands of dollars—or much more—in

AGMA On Line Video Training




New!

On Line Video Training

Detailed Gear Design

- Beyond Simple Service Factors
- Not for the Faint Hearted!
- 15 one-hour segments

Raymond J. Drago, P.E., Drive Systems Technology




Among the new AGMA learning options available are Ray Drago’s *Detailed Gear Design* as well as other on-demand online and video format presentations (courtesy R. Drago).

repair, downtime and or liability costs; think of a high-volume assembly line going down or a gear-related HVAC system failure in, for example, a hospital.) With that in mind, Errichello presents and explains the various types of gear failure, such as overload, bending fatigue, Hertzian fatigue, wear, scuffing and cracking. As well, the typical—and atypical—causes of these failures are presented, along with suggestions on how to avoid or correct them.

“We teach a gear failure analysis seminar and get a diverse student base from many different industries, not just the gear industry,” Errichello says. “Consequently, many don’t have an engineering background in gears. We find that their interest in gear failures piques their interest to know more about gear design and inspires them to take other courses to increase their knowledge in all aspects of gear design.”

Indeed, the course does indeed provide his students a leg up in finding—or retaining—employment in whatever industry they work. If, say, a student is a factory maintenance manager, you can bet that gears and gear drives—and their failure—are in play.

“Yes, most of our students work in industries that have gear failure problems, Errichello says. “Gear failure analysis is a unique skill that helps secure employment.”

And while Errichello readily admits that students taking his course are not going to “graduate” as gear experts, the program’s success speaks for itself. And how that affects potential job opportunities is a relative scenario.

“That (securing employment or promotion) depends on the circumstances of the employer. Some companies are willing to train on-the-job; others want entry-level people to have some gear experience. Our training in general failure analysis is a good background for students to learn about gears in general.”

Who benefits from this course: Attendees from an array of industries and job functions will gain an understanding of how to solve everyday problems—whether you are a gear engineer, user, researcher, maintenance technician, lubricant expert or manager.

And to get a head start on the learning experience, Alfieri advises that students would be wise to visit AGMA’s archived webinar that addresses metallurgy of gear materials, presented by Dr. Phil Terry, AGMA chairman/Technical Division Executive Committee. This webinar is highly recommended for those with no training in metallurgy.



Bob Errichello, Gear Failure Analysis instructor with Corny, a fondly remembered “best friend.” (courtesy B. Errichello).

RASO 250 TPC

NEW STANDARD IN SYNCHRO SHAVING

RASO 200 - RASO 400 - RASO 600 - RASO 250 TP/TPC
A complete range of gear shaving machines for advanced gear manufacturing
www.sicmat.com

Agents for U.S. and Canada: Star SU LLC
5200 Prairie Stone Parkway, Suite 100
Hoffman Estates, IL 60192
www.star-su.com

Upon completing the course: Students get to keep their course manual as a permanent reference and guide for failure analysis. It offers over 100 color photos, dozens of illustrations, a textbook and failure atlas. And perhaps most important, students completing the course and successfully completing a short quiz will receive a certificate for completion of 10 hours of advanced training.

Detailed Gear Design

Another waiting-list-only attraction is taught by longtime, indefatigable gear expert Ray Drago, chief engineer for Drive Systems Technology and a man of respect in the gear world. Drago presents this in-person (also online and video) course in 15 one-hour modules, along with supporting training documents. *Detailed Gear Design* teaches students about gear design and then challenges them with carefully crafted scenarios they are likely to face in their jobs and demonstrates practical application of optimization methods.

As with Errichello's gear failure module, Drago's *Detailed Gear Design* course is as timely as ever. That's because gearbox applications have proliferated in a great number of new applications. And, of course, that means there exists an ever-greater need for engineers to design them.

Drago concurs regarding gearbox growth.

"Yes, this is certainly true. Gears and gearboxes are omnipresent in a huge number of devices and industries. At this very moment, for example, the (Drive Systems Technology) team is working on gearbox applications, including a 'future' space

vehicle; coal and iron ore conveyor systems; helicopter gearbox manufacturing development; three very large, high-horsepower steel mill systems; a SAG mill; a fishing reel; pulper systems for paper processing; an automotive drive improvement; a crane drive; coal and cement mill drives; among a host of others.

"This extreme variety of applications affects our training approach in a very direct way. We start every class by advising our seminar participants that, regardless of application, similar gearbox technology can be successfully applied. That is not to say that all gear systems are the same. Rather, the underlying principles are similar across many applications. For exam-



Ray Drago, *Detailed Gear Design* and Gearbox CSI instructor, firmly believes that recruitment of tomorrow's engineers should begin in the earliest grade levels.



SPIRAL BEVEL GEARS

for demanding applications worldwide.



Keeps you in motion

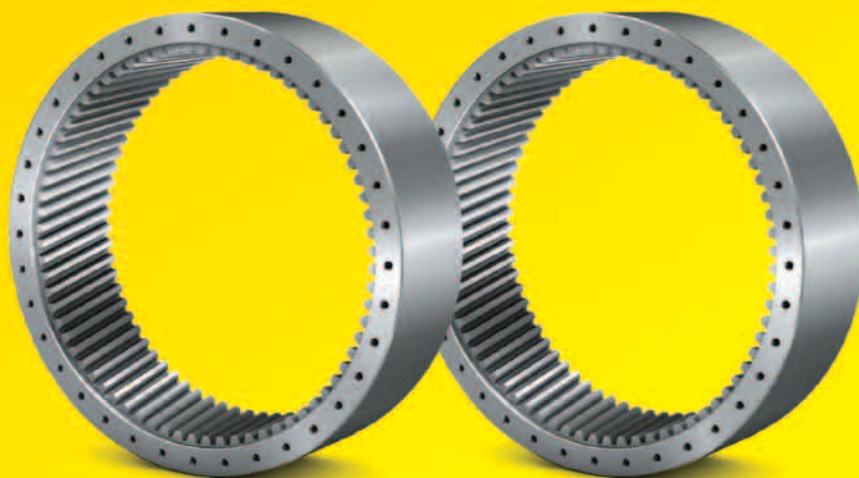
ATA GEARS LTD

P.O. Box 120 • FI-33101 Tampere FINLAND

Tel. +358 3 2870 111 • Telefax +358 3 2870 249

www.atagears.fi

Can you see the difference?



The ring gear to the right takes 20% less time to machine.

How is that possible? CoroMill® 170 is a high performance cutter for large gears in module range 12-22. In combination with our latest grades, your gear machining simply is more efficient, leaving minimal and even allowance for subsequent operations. Use it for precision and reliability in roughing of external and internal gears.

Sound interesting? It's just one solution we have for gear machining. Visit www.sandvik.coromant.com/us or better yet, get in touch with a Sandvik Coromant specialist at **1-800-SANDVIK**.

Think smart | Work smart | Earn smart



Your success in focus

ple, we are now working on two non-lubricated gear systems; one of them uses gears much less than one inch in pitch diameter, with a diametral pitch over 60, while the other involves a gear more than 12 feet in pitch diameter with a diametral pitch less than 1.0! In both cases, we apply the very same principles to minimize wear rate. It is this commonality that we try to convey to our seminar participants. I refer to this as adding to the seminar participants' gear technology 'bag of tricks.'"

Given that gearbox design is a very complex process requiring critical knowledge of gears and how they work, you'd reasonably think course attendees meet that standard.

Better think again.

"Our seminars are attended by folks with an extremely wide variety of backgrounds and we are occasionally completely surprised," says Drago. "One participant several years ago is particularly memorable. She was a woman whose age I guessed (correctly) as close to 70. I spoke with her at various breaks and finally asked what her job was and how she came to attend this particular seminar. She told me that she was a secretary at an old family-run, gear-related company and was not an engineer at all. She said that she was about to retire and her very long-term employer wanted to do something special for her.

"To her boss's surprise, she asked to attend this seminar so that she could finally understand what 'all her men' were talking about! Realistically, the fact that the seminar was held at the Sheraton Sand Key Resort in Clearwater Beach, Florida probably played into her request too.

"Over many years we have had a truly broad range of participants—from veteran gear engineers looking to update their skill and knowledge base to complete 'newbies' and even some still in college. In addition, we have folks who were not engineers at all, including purchasing agents, maintenance technicians—particularly for our *Gearbox CSI* seminar) and company executives who wish to gain a better understanding of the technology that is the basis of their various companies (*Please note: Gearbox CSI is another "hot-ticket" course, see page 84 for information*).

Listening to Drago, one gets it that the man is also a born entertainer. While the online and video versions of his instruction are all of equal technical value, the added, in-person human touch is always welcomed.

Continuing with his live events, "We have also modified our seminars for on-site presentation to special audiences. For example, we have been asked to present a seminar on the gearbox technology considerations required to enter the wind turbine gearbox arena at the national engineering and sales meeting of a major company, and another to present a summary of the 'state of the art' of gear system technology at a research and technology center for one of the major auto makers.

"Further, to address a broad need in the industry, we developed a seminar entitled '*Steel Mill Gearing Technology—A Practical Treatment for Engineers, Technicians, Managers and the Skilled Trades*.' As the name implies, attendees include all levels of involvement—from upper management to line-level millwrights and similar trades. The intent is

to provide all involved—from top to bottom—with a reasonable understanding of the importance of gearing in the operation of a steel mill (or any other primary processing industry)."

Who benefits from this course: Gear engineers, gear designers, application engineers, people who are responsible for interpreting gear designs, technicians and managers will come away with a better understanding of all aspects of gear design. The majority of the course material is presented through qualitative descriptions, practical examples, illustrations and demonstrations, which require basic mathematical and engineering skills. However, some familiarity with gear design and application will enhance overall understanding of the material.

Upon completing this course students will: See improvement in their gear designs; better understand gear rating theory and analysis methods; investigate differences in stress states among various surface durability failure modes; discuss time-dependent and time-independent failure modes related to tooth design; use computer-generated graphics to examine mesh action and tooth interaction; and gain new insight into the concepts presented through illustrations and demonstrations.

Fundamentals of Gearing/Gear Manufacturing

Presented by Dwight Smith (gearguy1@colemfgsystems.com; CEO Cole Manufacturing Systems, Inc.), along with Pete Grossi and Allen Bird, these online-only, ABCs of gearing courses provide a comprehensive overview of the industry. The basic course teaches students to set up machines for maximum efficiency, to inspect gears accurately, and to understand basic gearing. Although the basic course is designed primarily for newer employees with at least six months experience in setup or machine operation, it has proved beneficial to quality control managers, sales representatives, management, and executives.

In case you might be wondering, even though the course is basic in nature, you probably won't be seeing any "off-the-street" people attending the class.

"Although no one would be refused," says Smith, "I don't see it happening. This is specific and technical training, and, so far, 100 percent of the participants in my classes are engaged in the gear industry at some level."

"Walk-ons" notwithstanding, make no mistake: this "basic" course is for many attendees a gateway to the appreciation and understanding of an industry where, in many instances, quot-



Instructors (including front, left—Dwight Smith) and students alike at the AGMA Gear School at Chicago's Daley College (courtesy D. Smith).



The stock market report.

Stock news that's good? You bet: STOCK GROUND TOOTH Spiral Bevel Gears from the industry leader.

- Arrow Gear offers the broadest range of STOCK GROUND TOOTH Spiral Bevel Gears.
- Up to 16 inch dia., lapped and **NOW!! GROUND TOOTH** in stock for **IMMEDIATE DELIVERY**.
- Visit ARROWGEAR.COM for your stock gear solutions.

Now that's good news!



**ARROW
GEAR
COMPANY**



A quantum leap for the overall inspection of hob cutters!

The »hobCheck« combines leading ZOLLER measuring technology with the proven user-friendly and worldwide unrivalled software »pilot 3.0«.

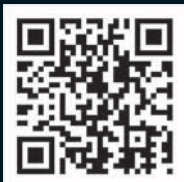


Worldwide unrivalled software »pilot 3.0«



»hobCheck«

You want to know more?



www.zoller-usa.com

ZOLLER
expect great measures

ing the old gospel standard, “99-and-a-half won’t do.” In short, precision rules.

“The training evolved from a perceived need,” says Smith. “I was involved in the sales and support of gear metrology systems, and customers frequently asked for information regarding what the inspection charts showed. It became clear that there was a void in the gear education arena, so I developed the Gear Basics seminars. This led to the involvement with the AGMA Basic School.

“Perhaps the concept most beneficial from the training is an understanding and appreciation for the function of gears, and the requirement for accuracy. The ability to apply knowledge of the inspection results to solving manufacturing problems is a valuable product of the class as well.”

The course begins with a little history of gearing and proceeds through the topics of:

- Gearing and nomenclature
- Principles of inspection
- Gear manufacturing methods
- Hobbing and shaping

Also helping in making these courses worthwhile are:

Steve Janke and Brelie Gear Co., Inc., who provide gear blanks especially for these classes. And Process Equipment Company (PECo), who generously loans out an ND 300 checker for use at all in-person classes.



There’s simply no substitute for hands-on experience with the tools of the trade (courtesy D. Smith).

Who benefits from these courses: Primarily for those with at least 6 months’ experience in setup or machine operation. However, past students have included executives, sales representatives and quality control managers.

Upon completing this course students will: Learn basic skills on manual machines; everything that students learn is valid and adaptable with CNC equipment commonly in use. By using manual machines, students can see the interaction between the cutting tool and the workpiece, thus better understanding the process and the physics of making a gear.

For more information—locations for upcoming live seminars; pricing; course availability; PC requirements and more—on all AGMA training opportunities and course formats, contact:

Jan Alfieri, Education Manager, American Gear Manufacturers Association, 1001 N. Fairfax Street/5th Floor, Alexandria, VA 22314-1587, Phone: (703) 838-0055, Fax: (703) 684-0242, alfieri@agma.org, www.agma.org