

REAL WORLD EDUCATION. REAL WORLD APPLICATION.



2020

Education Schedule of Classes





The International Association for Continuing Education and Training

American Gear Manufacturers Association (AGMA) is accredited by the International Association for Continuing Education and Training (IACET). AGMA complies with the ANSI/IACET Standard, which is recognized internationally as a standard of excellence in instructional practices. As a result of this accreditation, AGMA is accredited to issue the IACET CEU.

American Gear Manufacturers Association was approved and active status began December 2017.

A renewal occurs every 5 years to ensure compliance with the ANSI/IACET Standards. This accreditation focuses on the quality of AGMA Education and Training program.

AGMA Education meets the standard requirements which include:

	TITLE	WHAT DOES IT MEAN?
Category 1	Provide Organization, Responsibility, and Control	We have an established system for compliance with IACET Standards
Category 2	Provide Learning Environment and Support Systems	Our learning environments and support system reflects the intent/learning outcomes of the programs and the programs achieve the learning outcomes
Category 3	Planning and Instructional Personnel	We have qualified personnel planning and conducting our programs
Category 4	Needs Assessment	We have a process for conducting a formal needs analysis for the learning event that guides the development of planned learning outcomes and learning event design.
Category 5	Learning Outcomes	Course learning outcomes are based on identified needs and they are clearly provided to learners. They are measurable, achievable, realistic, and time-based.
Category 6	Content and Instructional Methods	Our methods are appropriate for each program
Category 7	Assessment and Learning Outcomes	We have established methods to assess achievement of learning outcomes
Category 8	Awarding the IACET CEU and Maintaining Learner Records	We have established methods to award CEUs and a system to maintain, protect and provide training records
Category 9	Evaluation of Learning Events	We systematically evaluate all learning events and content to ensure we are providing the best possible learning experience

CONTINUING EDUCATION UNITS

As an IACET Accredited Provider, AGMA offers CEUs for its programs that qualify under the ANSI/IACET Standard.

The IACET/CEU (CEUs) are calculated based on the number of minutes for instruction. Non-instructional portions of an activity are not considered learning time and, therefore, are not added to the instructional minutes. 1 CEU is equal to 10 hours of instruction. The learning activities allowed to receive CEU awards are face-to-face classes, distance courses, competency-based courses, and other learning events that meet the IACET/ANSI Standards. Partial credit or adjusted CEUs will not be awarded for individuals who do not successfully meet the criteria for achievement of CEUs.

.01 CEU is based on 60 minutes of instruction. CEUs are expressed in tenths and the minimum number of CEUs awarded is 0.1. If the resulting calculation ends in .5 or higher, we round up to the nearest whole number. For example, if the CEU calculation results in .26, the CEU award will be .3.

SAMPLE CALCULATION:

8 hours = 480 minutes
 480 minutes – 140 minutes of non-instructional time (lunch, breaks) = 340
 Divide 340 minutes/60 minutes = 5.81
 Multiply 5.81*.10 = .58
 .58 round to the nearest 10th
 Final CEU Award = .6

LEARNER SUPPORT

Need detailed information on courses?

Have a question about the certificate program requirements?

We are here to provide learner support services to assist you in achieving your professional development goals and objectives. Please contact us at education@agma.org to discuss your educational needs.



AGMA Education Department Mission and Certificate Programs

The education department continues to conduct programs that support the professional development of the gear manufacturing workforce that. Offering courses in face-to-face, online, and webinar formats, we strive to be a leader in gear education and training and embrace the expanded use of technology to reach our learners anytime, anywhere. We are committed to providing relevant, cutting edge, and challenging learning opportunities with an emphasis on learning outcomes and the application of knowledge to meet employer and learner needs.

Our Goals are to:

- Deliver training and education opportunities that build a knowledgeable, skilled workforce to more effectively and efficiently meet critical goals.
- Continually enhance the quality of the learning environment and the diversity of learning approaches to meet the needs of learners.
- Ensure that learning opportunities remain relevant.
- Continually assess and improve courses to assure desired learning outcomes are met.
- Attract, develop, and retain highly qualified, diverse instructors who are committed to our mission, who create a learning environment which is supportive and challenging, and who value service to others.

AGMA has established policies on:

- Student Record/Information Privacy
- Anti-Harassment/Discrimination
- Intellectual Property
- Proprietary Interest

For detailed information on such policies, please contact the Education Department at: education@agma.org.

AGMA Certificate Programs

A leader in Gear Education, AGMA continues to expand course offerings to meet the needs of the gear industry. Learners engage in professional development training by completing courses to earn the Advanced Gear Engineering Certificate and the Gear Manufacturing Certificate. It is quite an achievement and demonstrates a high level of commitment.

AGMA has expanded the certificate offerings to include the following:

Advanced Gear Engineering Certificate

Any combination of five advanced courses

Gear Manufacturing Certificate

- Basic Training for Gear Manufacturing
- Fundamentals of Gear Design and Analysis
- Gear Manufacturing and Inspection
- 2 additional courses

Advanced Gear Engineering Certificate

For International Industry Professionals (outside of North America)

- 3 Online Courses:
 - Detailed Gear Design
 - Gearbox CSI: Gears Only
 - Gear Failure Analysis
- 2 Face-to-Face Courses

More than 3,000 individuals have completed courses through AGMA's Education Department. For these dedicated individuals, taking the series of classes consists of more than 90 hours of classroom instruction. We are proud that our industry leaders are committed to assisting their employees in gaining valuable knowledge and insight to retain a qualified and skilled workforce by making these training opportunities available.



AGMA On-Site Training

AGMA now offers custom on-site/in-house training! We understand that training can be costly to your bottom line but it still remains a necessary component for your company to remain on the cutting edge of gear knowledge in order to implement best practices in your workplace. We recognize how important this balance is and so we have begun to work with companies that bring the instructors directly to your facilities!

Benefits of On-Site Training

Cost Savings

Again, you are cost-conscious — so are we! By bringing an AGMA course to your location, you can eliminate the cost of sending your staff to another location. Your organization will:

- Eliminate travel costs
- Maximize employee training time
- Increase the productivity of your most valuable asset
- Boost your employee retention program
- Reduce turnover

Convenience

- Choose the best time to learn based on your employees' workloads and schedules
- Benefit from courses that fit your needs
- Training in your facility or shop

Relevance

- Tailor the courses to incorporate examples and content specific to your company's needs and challenges.

Succession Planning

- Reduce the impact of the knowledge gap as new hires start and seasoned workers retire
- Increase cross-training activities to enhance and diversify the skills of your workforce

Privacy

Having training at your own facility keeps your training needs and proprietary interests private. This allows your team with the ability to speak as freely as needed.

Accredited

AGMA is accredited by the International Association for Continuing Education and Training (IACET). AGMA complies with the ANSI/IACET Standard, which is recognized internationally as a standard of excellence in instructional practices. As a result of this accreditation, AGMA is accredited to issue the IACET CEU.

Ready to bring industry-leading gear education to your workplace?

***Contact us today at
703-684-0211 or
Education@agma.org!***

Scheduling your On-site Training

1. Determine which course you would like delivered to your employees based on your organization's priorities, challenges, and what your employees need to know.
2. Request a quote by contacting Casandra Blassingame, Vice President, Education Services at 703-684-0211 or by email to Education@agma.org.
3. Schedule your custom training program.
4. Participate in a planning and implementation conference call with the AGMA Education team.
5. Prepare for Training Day.



Supply Chain Management Certificate Program

SUPPLY CHAIN MANAGEMENT

AGMA has partnered with Ranken Technical College in St. Louis, MO to bring a series of supply chain management courses to the business side of the house. Ranken's Supply Chain Management Certificate Program is offered completely online every 8 weeks. The program curriculum will also prepare students for the Council of Supply Chain Management (CSCM) SCPro Certification.

To register and for more information, visit
www.AGMA.com/education



**AGMA
Foundation**

The development of AGMA's four NEW Operator Level Classes and Supply Chain Training; as well as the online Workforce Training Series, Detailed Gear Design, Gear Failure Analysis, and the Gearbox CSI curriculum, were made possible through grants from the AGMA Foundation. AGMA thanks the Foundation, and its donors, for their continued support and partnership in educating the gear industry.

Fees: Member \$695/course | Non-member: \$1,195/course

Course Dates:

Integrated Supply Chain Management	February 3 – March 29, 2020 August 24 – October 11, 2020 January 18, 2021 – March 4, 2021
Inventory Management	May 2 – June 28, 2020
Manufacturing and Service Operation	February 3 – March 29, 2020
Customer Service and Order Fulfillment	May 2 – June 28, 2020
Transportation	August 24 – October 11, 2020
Warehousing Management	January 18, 2021 – March 4, 2021

Supply Chain Management Certificate Program Topics include:

Integrated Supply Chain Management

This course provides a solid foundation of knowledge of supply chain management concepts, components, and principles.

Inventory Management

This course provides an understanding of fundamental concepts of inventory management and the strategic role that inventory plays in the modern supply chain environment.

Manufacturing and Service Operation

This course covers the planning, organizing, controlling, directing, motivating and coordinating functions used to produce goods or services.

Customer Service and Order Fulfillment

This course brings together authoritative knowledge about all facets of order fulfillment and customer service process management throughout the supply chain.

Transportation

This course focuses on the key principles, strategies, and decisions required for the cost efficient, effective flow of goods between sellers and buyers.

Warehousing Management

This course will cover basic warehousing storage and handling operations, strategic planning, and the effects of warehousing design and service decisions on total logistics costs and customer service.



Online Education Offerings

Can't make a live session? *We bring t*

Online learning proves to be a great alternative to attending a face-to-face course. It is cost-effective and allows you to work at your own pace - anytime and anywhere. Learn the basics of the gear industry through the Online Workforce Education series and other advanced topics through the Online Video Training courses and Webinars.

The three-module Online Workforce Education series provides a basic overview for those new to the industry or for individuals that work in areas outside of engineering. In addition, those who work in human resources and/or sales also benefit from this series.

Visit www.learning.agma.org

Online Video Training Courses

Detailed Gear Design

Member Fee: \$1,095 | Non-member Fee: \$1,595

Students can get the full experience of the course through more than 15 hours of video and supporting training documents. Learn about gear design and examine carefully crafted "problems" that will demonstrate the practical application of the optimization methods presented in this seminar.

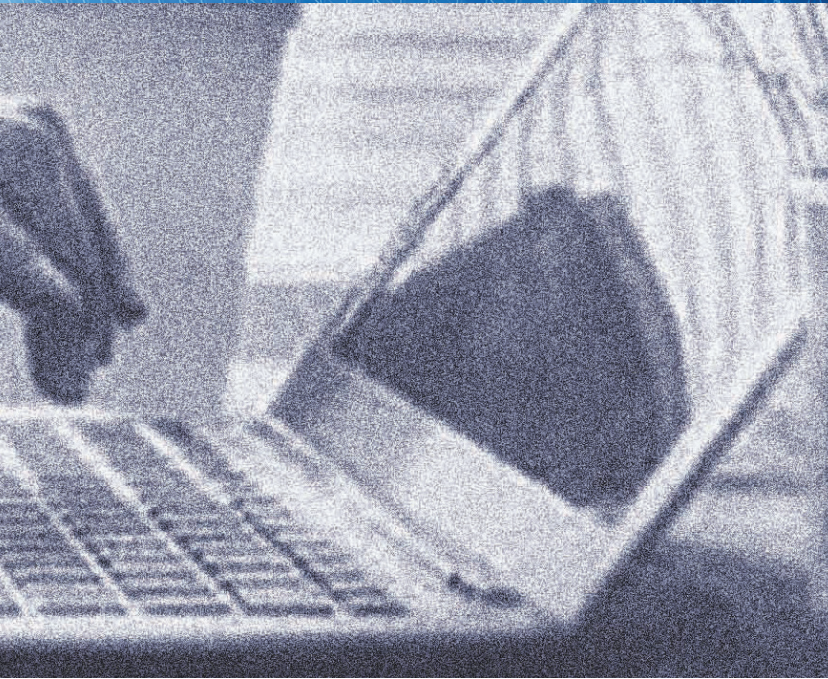
Facilitator: Raymond Drago, P.E. of Drive Systems Technology, Inc.

Gear Failure Analysis

Member Fee: \$995 | Non-member Fee: \$1,495

Students get the experience of the course through 10 hours of in-depth discussion of gear failure modes and supporting training documents. Learn the causes of gear failure and how to prevent it from occurring. You will also examine the various types of gear failure, such as overload, bending fatigue, Hertzian fatigue, wear, scuffing and cracking. Possible causes of these failures will be presented, along with some suggested ways to avoid them.

Facilitator: Robert Errichello, P.E., of GEARTECH



the experts to you!

Gearbox CSI: Gears Only

Member Fee: \$795 | Non-member Fee: \$1,295

This webinar focuses on the gear part of the Forensic Analysis of Bearings and Gear course. It helps gear designers gain a better understanding of various types of gears. This is a four-part series where you will learn about properly applying the best gear-bearing combination to any gearbox, simple or complex.

Facilitator: Raymond Drago, P.E. of Drive Systems Technology, Inc.

Workforce Training Series

FREE for AGMA Members | Non-member Fee: \$395/course

This self-directed series, free for AGMA members, provides a comprehensive overview of gearing to enhance students' understanding of essential terminology and practices within the industry.



Fundamentals of Gearing

This course is a comprehensive overview of the industry. It begins with a little history of gearing and proceeds through the topics of parallel axis gear basics; involute tooth form; description of the gear; diametrical pitch/module; pitch; and pressure angle.

Parallel Gear Inspection

The gear inspection module includes basic concepts for gear measurement, the tools and instruments used, the evaluation of gear characteristics, definitions of terms, and introduction to gear classification.

Hobbing

This course is designed to present the basics of hobbing to hobbing machine operators, gear technicians, and engineers.

Webinars

FREE for AGMA Members | Non-member Fee: \$195/course

AGMA continues to provide top quality education products to members of the gear industry. Sign up for a live webinar, or download one of the previously presented webinars. Watch it independently or with your entire staff!



For Live Webinars

Webinars are broadcast over the internet and sound is available either through your device speakers or audio on your phone. A toll-free number will be provided for each event. The log-in information is sent out several days prior to the event. Testing of your computer connection prior to the event is suggested and instructions will be provided with the login information. Free technical support is available.

For Previously Recorded Webinars

All sessions are recorded and sessions and handouts are available as on demand downloads.



Operator Level Course Offerings

Basic Gear Inspection for Operators

1.3 CEUs

April 21-22, 2020

Chicago, IL

Instructors: William 'Mark' McVea, PhD., P.E.

Fees:

\$995 First registrant per member company | \$795 additional registrant
\$1,495 First registrant non-member company | \$1,295 additional registrant

Learn the common, current and basics of the tools and techniques used to measure and inspect gears. There are four main categories by which a gear evaluated and classified. Gear design, manufacture and inspection are based on numerical scale that defines gear quality. The methodology to measure and techniques required to quantify quality of a gear tooth form will be thoroughly investigated and explained. It is often stated that quality cannot be inspected into the part, however inspection can tell us what to do to correct many issues.

Learning Objectives:

- Describe the differences between measurement and inspection
- Thorough review of measurement techniques
- Thorough review of inspection results
- Use Means and methods to interpret and use the outcomes of both measurements and inspection to guide better gear production
- Describe of manufacturing and process cause and effect as defined by the results of gear inspection
- Explain the correlation between manual measurement techniques and how automated GMM (Gear Measurement Machine systems) perform the same task
- Be able to explain the automated processes used by GMM systems to assess gear quality
- Review of applicable standards

Operator Hobbing and Shaper Cutting

1.3 CEUs

May 12-13, 2020

Chicago, IL

Instructor: Peter Grossi

Fees:

\$995 First registrant per member company | \$795 additional registrant
\$1,495 First registrant non-member company | \$1,295 additional registrant

Learn and understand fundamentals of gear manufacturing. Acquire knowledge and understanding of gear nomenclature, hobbing and shaping of spur and helical gears, and splines. Learn and understand hobber and shaper machine set-up, as well as gear tooth element inspection. Understand the manufacturing process before gear tooth cutting, as well as post cutting processes. Apply concepts to further finishing processes, i.e. heat treat, gear tooth shaving and grinding and/or skiving. Gain knowledge to establish a solid foundation for all basic gear manufacturing.

Learning Objectives:

- Identify gear blank inaccuracies.
- Establish proper machine set-up procedures / practices.
- Define gear tooth element nomenclature.
- Identify gear tooth errors resulting from hobber / shaper machine set-up errors., as well as cutter sharpening errors.
- Interpret gear inspection charts for quality level.



Operator Grinding Course

1.3 CEUs

June 23-24 2020

Chicago, IL



Heat Treatment Equipment Operator

1.3 CEUs

September 9-10, 2020

Chicago, IL



Instructors: Terrance Klaves

Fees:

\$995 First registrant per member company | \$795 additional registrant
\$1,495 First registrant non-member company | \$1,295 additional registrant

Explore processes, machine setup, pitfalls, failures and expectations related to finish ground gearing. Learn definitions of gearing component features, process steps from blanking, through heat treatment to finished part ready to ship. Study aspects of Quality Assurance, Inspection Documentation and corrective actions for measured non-conformances. Understand pre-heat treat, heat treatment and post heat treatment operations including the how's and why's to produce finished gears that conform and perform to end user expectations.

Learning Objectives:

- Review and challenge control of part datums for pre-heat treatment operations, use datum's consistently through finishing operations given part prints
- Anticipate and correct for part distortion during heat treatment knowing the actual heat treatment process used.
- Ask questions of gear designers and manufacturing engineers to acquire all information required to produce conforming finished gears
- Accurately apply and inspect pre-calculated micro-geometry modifications derived from complex contact analysis software
- Perform component finishing machine setup, alignments, component inspection and calibrations to established ISO standards
- Select the optimum grinding wheel specification given part print and heat treatment used
- Achieve compliance with finished parts to meet print requirements and customer performance expectations
- Accurately measure pre and post finish gear tooth thickness given finished tooth thickness specifications
- Avoid and detect the presence of Twist Error and grind burn temper
- Avoid typical gear fatigue failure modes
- Identify common non-conformances, apply problem solving techniques and corrective actions

Instructor: William 'Bill' Andreski

Fees:

\$995 First registrant per member company | \$795 additional registrant
\$1,495 First registrant non-member company | \$1,295 additional registrant

This course provides the operator the means to perform the heat treatment of steel gears in a manner that meets the AGMA and customer requirements in a safe and efficient manner. The course identifies the key information needed for proper processing. Sufficient metallurgical background is provided to allow the student to identify how this information relates to the required properties of the gear.

Learning Objectives:

- Identify and locate the required information for material, process and equipment for gear heat treatment
- Recognize how the various heat treatment processes apply to the relevant AGMA documents
- Perform preparation to product and equipment for heat treatment in an efficient and safe manner.
- Operate and monitor heat treat equipment, and perform quality control processes.
- Perform post-heat treatment processes, Go/No-Go material inspections and cycle documentation reviews.



Basic Level Course Offerings

Basic Training for Gear Manufacturing

2.7 CEUs

April 13-17, 2020

September 21-25, 2020

Chicago, IL



Basics of Gearing

1.3 CEUs

July 14-15, 2020

Chicago, IL



Instructors: **Dwight Smith, Allen Bird, and Peter Grossi**

Fees:

\$1,595 First registrant per member company | \$1,395 additional registrant
\$2,095 First registrant non-member company | \$1,895 additional registrant

Learn the fundamentals of gear manufacturing in this hands-on course. Gain an understanding of gearing and nomenclature, principles of inspection, gear manufacturing methods, hobbing and shaping. Utilizing manual machines, develop a deeper breadth of perspective and understanding of the process and physics of making a gear as well as the ability to apply this knowledge in working with CNC equipment commonly in use.

This course is taught at Daley College. A shuttle bus is available each day to transport students to and from the hotel.

Learning Objectives:

- Demonstrate understanding of the evolution, history, and function of gears
- Show and describe 14 gear tooth features
- Describe six typical gear characteristics that are measured
- Demonstrate knowledge of gauging vs. measurement
- Utilize and describe a variety of analysis methods
- Troubleshoot many of their own problems, because they fully understand the process

Instructor: **William 'Mark' McVea, PhD., P.E.**

Fees:

\$995 First registrant per member company | \$795 additional registrant
\$1,495 First registrant non-member company | \$1,295 additional registrant

This 2-day course provides a solid and fundamental understanding of gear geometry, types and arrangements, and design principles. Starting with the basic definitions of gears, conjugate motion, and the Laws of Gearing, those attending will be given the tools needed to understand the inter-relation and coordinated motion operating within gear pairs and multi-gear trains. Basic gear system design process and gear measurement and inspection techniques will also be explained. In addition, the fundamentals of understanding the step-wise process of working through the iterative design process required to generate a gear pair will be reviewed, and attendees will also briefly discuss the steps and issues involved in design refinement and some manufacturing considerations. Also, an explanation of basic gear measurement techniques, how measurement equipment and test machines implement these techniques, and how to interpret the results from these basic measurements will be covered.

This course is taught at Daley College. A shuttle bus is available each day to transport students to and from the hotel.

Learning Objectives:

- Describe the "Law of Gearing," conjugate action and specifically, involute profiles
- Review the various definitions and terms used in gearing
- Identify the function and operation of all gear arrangements
- Appraise preliminary design considerations and the gear system design process
- Explain practical gear measurement and inspection techniques, tools and equipment
- Recognize "Best Practices" regarding gear system design
- Discuss some of the new and automated gear design systems

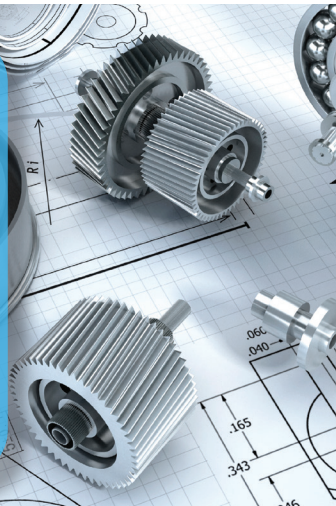


Fundamentals of Gear Design and Analysis

1.7 CEUs

August 11-13, 2020

Chicago, IL



Instructor: William 'Mark' McVea, PhD., P.E.

Fees:

\$1,595 First registrant per member company | \$1,395 additional registrant
\$2,095 First registrant non-member company | \$1,895 additional registrant

Gain a solid and fundamental understanding of gear geometry, types and arrangements, and design principles. Starting with the basic definitions of gears, conjugate motion, and the Laws of Gearing, learn the tools needed to understand the inter-relation and coordinated motion operating within gear pairs and multi-gear trains. Basic gear system design process and gear measurement and inspection techniques will also be explained. In addition, the fundamentals of understanding the step-wise process of working through the iterative design process required to generate a gear pair will be reviewed. Learn the steps and issues involved in design refinement and some manufacturing considerations. An explanation of basic gear measurement techniques, how measurement equipment and test machines implement these techniques, and how to interpret the results from these basic measurements will also be covered.

This course is taught at Daley College. A shuttle bus is available each day to transport students to and from the hotel.

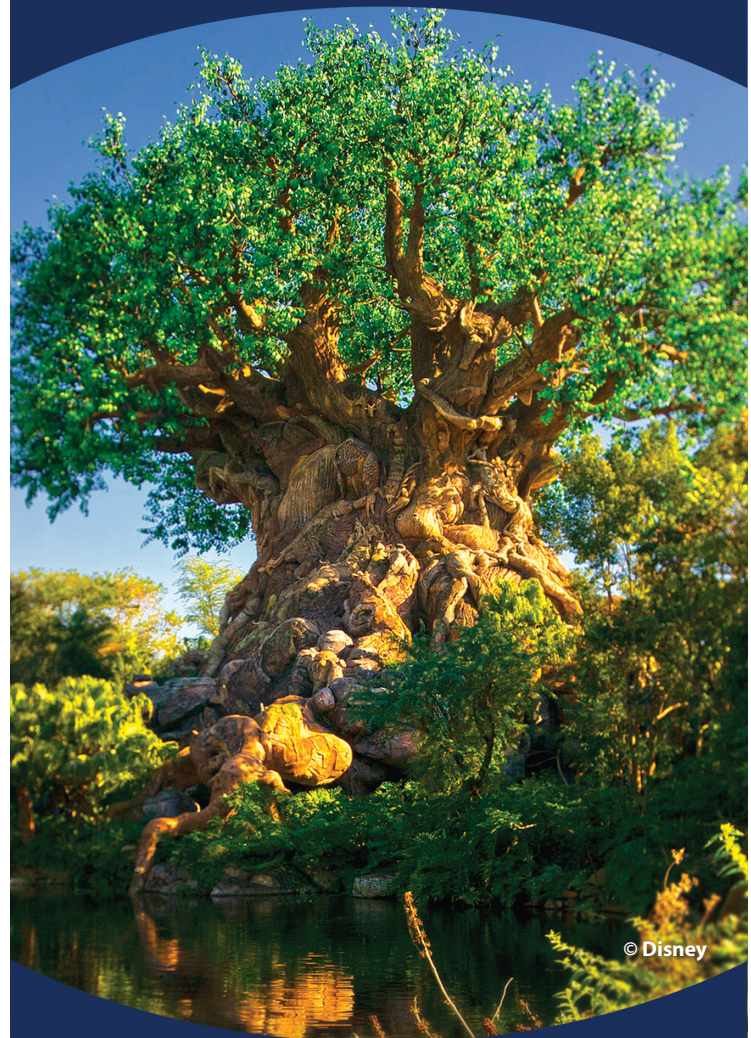
Learning Objectives:

- Develop a full appreciation for the meaning and correct use of gear nomenclature
- Describe conjugacy and its relationship to transmission error
- Appreciate and be able correctly select the basic geartrain arrangements as a function of application
- Be able to describe and discuss the external factors that effect a gear pair and / or a geartrain
- Describe how the applied torque manifests itself as a force on the surface of the tooth and further how this develops into stress within the body of the tooth
- Be able to describe and discuss the various common manufacturing techniques for gears
- Describe the measurement and inspection techniques used to qualify a gear
- Develop a high-level of appreciation for various gear failure modes and causes

AGMA ABMA 2020 Annual Meeting

Inspiring Growth

In your business. In your workforce. In your connections.



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March 19-21, 2020

Lake Buena Vista, Florida

Disney's Grand Floridian Resort & Spa



American
Gear Manufacturers
Association

ABMA
American Bearing Manufacturers Association
INDUSTRY IN MOTION

www.agma.org • www.americanbearings.org



Advanced Level Course Offerings

Gear Manufacturing & Inspection

2.0 CEUs

January 28-30, 2020

Garden Grove, CA



Fundamentals of Worm and Crossed Axis Helical Gearing

2.0 CEUs

February 18-20, 2020

Alexandria, VA

Instructors: **Raymond J. Drago, P.E.**

Fees:

\$1,595 First registrant per member company | \$1,395 additional registrant
\$2,095 First registrant non-member company | \$1,895 additional registrant

Discover key factors in the inspection process that lead to better design of gears. Develop a broad understanding of the methods used to manufacture and inspect gears. Interpret how the resultant information can be applied and interpreted in the design process.

This course also includes a tour of Western Precision Aero. Participants will be required to fill out paperwork prior to the tour and must be US citizens. AGMA will distribute the paperwork upon registration.

Learning Objectives:

- Identify methods of manufacturing external and internal spur, single and double helical, and bevel and worm gears
- Describe the methodology and underlying theory for basic manufacture and inspection of each.
- Discuss the “features” associated with each manufacturing method with regard to their impact upon and their ability to refine, guide and optimize the design process.
- Take two views of the same results: meeting a “specification” and determining acceptability for a specific application, and interpreting the inspection data for purposes other than simply determining accept/reject status.
- Specify the data required to control both the manufacturing and inspection processes on an engineering drawing. This includes both the data to be defined and the presentation of the data on the engineering drawing.
- Discuss the basics of a variety of destructive and nondestructive inspection tests, including their underlying theory, application techniques and, most importantly, interpretation of the resultant data.

Instructor: **William ‘Mark’ McVea, PhD., P.E.**

Fees:

\$1,695 First registrant per member company | \$1,495 additional registrant
\$2,195 First registrant non-member company | \$1,995 additional registrant

Provides an introduction and emphasize the differences between parallel (the experience base) axis and worm and crossed axis helical gears. Describe the basics of worm and crossed axis helical gears, their fundamental design principals, application guidelines and recommendations, lubrication requirement, a discussion of accuracy and quality and summarize with a brief review of common failure modes.

Learning Objectives:

- Define the basic differences between parallel axis, common crossed intersecting axis and worm / wheel and crossed axis helical gears
- Interpret and discuss the design and applications specifics as they apply to worm / wheel and crossed axis helical gears
- Assess lubrication, cooling and support requirements for worm / wheel and crossed axis helical gears
- Explain the cause of a particular failure of a worm / wheel or crossed axis helical gear pair, as a function of application or use



Steels For Gears Applications

2.0 CEUs

March 24-26, 2020

Alexandria, VA

Gearbox CSI

2.0 CEUs

May 19-21, 2020

Concordville, PA

Instructors: Göran Nyström & Hans-Willi Raedt

Fees:

\$1,595 First registrant per member company | \$1,395 additional registrant
\$2,095 First registrant non-member company | \$1,895 additional registrant

Gain a basic understanding of steel and its properties. Learn to make use of steel properties in an application and understand the potential that different steel and heat treatment options can offer. Explore how performance of the material depends on how the steel is produced.

Learning Objectives:

- Understand how material properties are affected by steel quality and heat treatment.
- Describe how stresses are introduced by heat treatment process and surface modification treatments.
- Understanding how to select a steel and heat treatment combination to meet the demands of the application
- Review influence of material selection on the manufacturing of components
- Discuss how to verify and specify required steel properties

Instructor: Raymond J. Drago, P.E. & Joseph Lenski

Fees:

\$1,895 First registrant per member company | \$1,695 additional registrant
\$2,395 First registrant non-member company | \$2,195 additional registrant

Gain a better understanding of various types of gears and bearings. Learn about the limitation and capabilities of rolling element bearings and the gears that they support. Grasp an understanding of how to properly apply the best gear-bearing combination to any gearbox from simple to complex.

Learning Objectives:

- Apply understanding of forensic analysis of gearbox failures in future gearbox designs
- Discuss bearing and gear types
- Explain how bearing selection is influenced by gear type and loading
- Select appropriate bearing types and configurations as influenced by gear type and loading
- Explain how to optimize bearing and gear combination
- Identify seven materials and manufacturing related defects

2020 Fall Technical Meeting

October 19-21, 2020 • Crowne Plaza, Rosemont • Rosemont, IL

SAVE THE DATE



American
Gear Manufacturers
Association



Advanced Level Course Offerings

Gear Failure Analysis

2.0 CEUs

June 16-18, 2020

November 10-12, 2020

St. Louis, MO

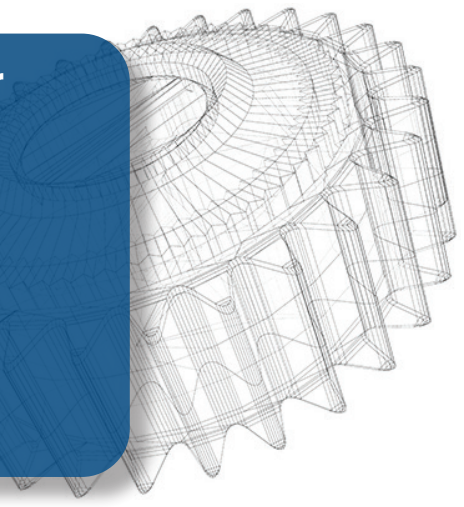


Detailed Gear Design

2.0 CEUs

July 21-23, 2020

St. Louis, MO



Instructor: Rob Budny & Andrew Milburn

Fees:

\$1,895 First registrant per member company | \$1,695 additional registrant
\$2,395 First registrant non-member company | \$2,195 additional registrant

Explore gear failure analysis in this hands-on seminar where students not only see slides of failed gears but can hold and examine those same field samples close up. Use of a microscope to examine field samples.

This course is taught at Ranken Technical College. A shuttle bus is available each day to transport students to and from the hotel.

Learning Objectives:

- Identify the primary and secondary failure modes
- Use the proper nomenclature to describe the morphology of gear failure
- Understand common tools and methods used in gear failure analysis
- Diagnose the root causes of failure
- Prescribe remedies to prevent repeat failures
- Use the GEARTECH textbook and other provided resources for ongoing study of gear failure analysis
- Tailor failure analysis techniques for their specific requirements

Instructors: Raymond J. Drago, P.E.

Fees:

\$1,895 First registrant per member company | \$1,695 additional registrant
\$2,395 First registrant non-member company | \$2,195 additional registrant

Learn how to improve gear designs and gain new insight into concepts presented through illustrations and demonstrations. Explore all factors that go into good gear design from life cycle, load, torque, tooth, optimization, and evaluating consequences.

This course is taught at Ranken Technical College. A shuttle bus is available each day to transport students to and from the hotel.

Learning Objectives:

- Improve gear designs
- Apply understanding of 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
- Discuss the concepts presented



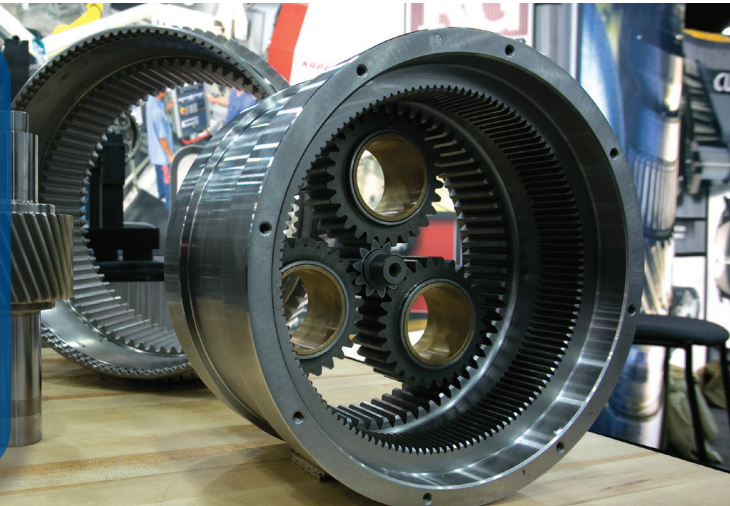


Epicyclic Gear Design

2.0 CEUs

August 25-27, 2020

Chicago, IL



Instructors: Raymond J. Drago, P.E. & Steve Cymbala

Fees:

\$1,695 First registrant per member company | \$1,495 additional registrant
\$2,195 First registrant non-member company | \$1,995 additional registrant

Learn and define the concept of epicyclic gearing including some basic history and the differences among simple planetary gear systems, compound planetary gear systems and star drive gear systems. Cover concepts on the arrangement of the individual components including the carrier, sun, planet, ring and star gears and the rigid requirements for the system to perform properly. Critical factors such as load sharing among the planet or star gears, sequential loading, equal planet/star spacing, relations among the numbers of teeth on each element, calculation of the maximum and optimum number of planet/star gears for a specific system will be covered. Provides an in-depth discussion of the methodology by which noise and vibration may be optimized for such systems and load sharing guidelines for planet load sharing.

This course is taught at Daley College. A shuttle bus is available each day to transport students to and from the hotel.

Learning Objectives:

- Restate exactly what makes a gear system an epicyclic system
- Calculate the total reduction ratio of an epicyclic system and that of a star system.
- Identify differences and similarities between split power systems and true epicyclic systems.
- Recognize when the use of a star drive system is preferred over a planetary system.
- Understand the importance of equal planet/star gear spacing and how a system be designed with unequal planet spacing.
- Interpret how the numbers of teeth selected for the individual gears in an epicyclic or star drive gear system affect the noise and vibration characteristics of the system.
- Identify are the advantages of selecting odd numbers of teeth for the planet/star gears?
- Evaluate the numbers of teeth on the sun, planet and internal ring gear not arbitrary and what are the relations that must be maintained among these tooth numbers and why
- Explain how the design of the carrier affects the overall performance of these complex systems
- Determine how does input speed affect the design of an epicyclic system and why are the speed concerns different for epicyclic and star drive systems
- Restate how the selection of the "fixed" member in a planetary system affect the ratio and relative rotation directions of the input and output shafts?
- Understand the design and use of load balancing systems including floating sun gears, and floating ring gears.





Gearbox System Designs

2.0 CEUs

October 13-15, 2020

Clearwater Beach, FL

Instructors: Raymond J. Drago, P.E. & Steve Cymbala

Fees:

\$1,895 First registrant per member company | \$1,695 additional registrant
\$2,395 First registrant non-member company | \$2,195 additional registrant

This course focuses the supporting elements of a gearbox that allow gears and bearings to do their jobs most efficiently. Learn about seals, lubrication, lubricants, housings, breathers, and other details that go into designing gearbox systems.

Learning Objectives:

- Understand types of housing construction, housing elements (covers, inspection ports, sump, mounting, etc.)
- Apply drawing practices for housings and related components
- Bearing mounting, retention and sealing
- Understand election and role of gearbox accessories, such as breathers, filters, screens, sight gages, and other level indication devices
- Apply the appropriate lubricant selection
- Apply the lubricant to the rotating elements
- Describe the selection criteria concerning the basic lubricant chemistry. Since the best design is only as good as its implementation, drawing practices and tolerancing will also be addressed from the designers' perspective.
- Learn about translating the general design from the design manual to the individual component drawings.

Gear Systems Design for Minimum Noise

2.0 CEUs

December 1-3, 2020

Phoenix, AZ

Instructors: Raymond J. Drago

Fees:

\$1,895 First registrant per member company | \$1,695 additional registrant
\$2,395 First registrant non-member company | \$2,195 additional registrant

The general nature of noise and its measurement will be examined, with particular emphasis on terminology standards, and units of measurement appropriate to gear technology. Before attempting to solve a noise problem with an existing unit or beginning the design of a new unit, the nature of the noise must be defined. Both experimental and analytical methods will be covered, with particular emphasis on application rather than theory. The many factors that influence the noise produced by a gear system will be discussed. The relative effects of each factor will be studied qualitatively. Factors to be considered include gear tooth geometry and accuracy, speed, materials, housing design, bearing type, gear type, air entrapment, root clearance, interference alignment, surface finish, and phasing.

Learning Objectives:

- Understand the need for gearbox system noise control and, especially, the difference between "gear noise" and "gearbox system noise"
- Become familiar with the "nature" of noise and its measurement as well as terminology standards, and units of measurement appropriate to gear technology.
- Learn the mechanisms by which observer noticed noise is generated and transmitted
- Gain a knowledge of the experimental and analytical methods for measuring noise, with particular emphasis on application rather than theory.
- Explain the importance of equal planet/star gear spacing and how a system be designed with unequal planet spacing.
- Understand the various design and manufacturing factors that influence gear system noise including gear tooth geometry and accuracy, speed, materials, housing design, bearing type, gear type, air entrapment, root clearance, interference alignment, surface finish, and phasing.
- Recognizing that it is often necessary to address noise issues after the gearbox system is designed, learn how enclosures, absorbers, dissipative dampers, isolators (gearbox and gear blank), and impulse phasing can be applied to existing systems to reduce noise level.



Essential Concepts of Bearing Technology

August 4-6, 2020

Chicago, IL



Advanced Concepts of Bearing Technology

June 9-11, 2020

Chicago, IL



Instructors: **Dr. Tim Ovaert, Dan Snyder and Vern Wedeven**

Fees:

\$2,150 per member company registrant

\$2,450 per non-member company registrant

This course will give you an overview of the bearing industry as well as basic bearing types and applications. Knowledge of the key players, bearing types and terminology will ensure that everyone has a basic knowledge of the industry upon arrival.

This course is specially designed for engineers and others with technical backgrounds that have limited exposure to bearings and need to adapt their technical training to bearings or seek an upgrade to their technical knowledge. The Essentials Course focuses on understanding basic tribology, bearing types and applications and explores the basic concepts around manufacturing methods, loads, lubrication and failure.

Course participants will gain knowledge in:

- Rolling Bearing Types, Applications,
- Macrogeometry & Standards
- Bearing Loads & Applications: Static and Dynamic
- Mounting Methods: Shaft & Housing Fits
- Contact Stresses – Surface & Subsurface
- Bearing Load Sharing & Internal Loading
- Bearing Pre-Load NEW
- Materials for Ball & Roller Bearings
- Concepts in Friction, Lubrication & Wear
- Ball & Roller Bearing Deflections & Stiffness
- EHL & Lubrication Methods
- Failure Modes in Rolling Bearings
- Bearing Life Standards & Calculation Methods
- Failure Modes with Examples

Instructor: **Dr. Tim Ovaert and Dan Snyder**

Fees:

\$2,150 per member company registrant

\$2,450 per non-member company registrant

This course builds on the foundations of the essential course and challenges the experienced engineer in areas such as failure modes, friction & wear, fatigue life calculation methods and load distribution. This is an exceptional course for engineers with 2-3 years work experience in bearings or past attendees of the Essential Concepts of Bearing Technology.

Course participants will gain knowledge in:

- Bearing Macrogeometry: Clearance, Free Contact Angle, Interference Fits
- Ball/Roller Loading: Static/Inertial
- Contact Stresses, Deflection, & Subsurface Stresses
- Internal Load Distribution – Speed & Motion
- Concepts of Friction & Wear: Surface Topography
- Fundamentals of Fatigue Life Theory
- Contact Friction
- Bearing Friction & Reference Speeds
- Permanent Deformations & Static Capacity
- Fatigue Life Prediction: Standards & Advanced Calculations
- Testing Methods & Statistical Analysis
- Lubricants & Rheology & EHL
- Shaft-Bearing Systems & Performance Analysis



Lube & Wear Advanced Concepts

May 12-14, 2020

Chicago, IL

Instructors: **Dr. Tim Ovaert**, **Vern Wedeven** and **Chuck Coe**

Fees:

\$1,500 per member company registrant

\$1,800 per non-member company registrant

The field of lubrication and wear continues to evolve and this course introduces the relevant phenomena pertaining to surface topography measurement and analysis, analyzing surfaces in contact, lubrication films, and friction appropriate to rolling element bearings, sliding machine elements, and mechanical systems. The course bridges the gap between component design and component failure as a result of relative motion between surfaces in contact.

This course is designed for engineers and scientists in the rolling element bearing and power transmission industries who desire a more fundamental knowledge of the lubrication, friction and wear sciences.

Course participants will enhance understanding of:

- Regimes of Lubrication
- 2-D and 3-D Surface Topographical Characterization
- 2-D and 3-D Contact Mechanics
- Surface and Subsurface Stress Analysis
- Asperity Contact Models
- 2-D and 3-D Elastohydrodynamic Lubrication (EHL)
- Transient and Micro-EHL
- Mixed Lubrication
- Grease Lubrication
- Applications in Rolling Element Bearing Design
- Failure Modes and Materials in Bearing Lubrication



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The American Bearing Manufacturers Association

Founded in 1917, the American Bearing Manufacturers Association (ABMA) has long and rich history, which includes aiding in the production of bearings in World War I and fighting counterfeit bearings around the world. ABMA provides leadership, advocacy and education on issues impacting the global bearing industry. ABMA's members include manufacturers of bearings and finished components as well as suppliers to the bearing industry. Participants from member companies are CEOs and senior executives—the key decision-makers and the most successful and forward thinking leaders in the bearing industry. Engage with ABMA to gain access to membership opportunities, receive updates on industry news, attend courses, or become a key partner.



The development of AGMA's four NEW Operator Level Classes and Supply Chain Training; as well as the online Workforce Training Series, Detailed Gear Design, Gear Failure Analysis, and the Gearbox CSI curriculum, were made possible through grants from the AGMA Foundation.

The AGMA Foundation also awards annual scholarships at the undergraduate and graduate school levels. In fact, 86% of the scholarship recipients have embarked on careers in gear manufacturing and design.

Contact Cindy Bennett, Executive Director, at bennett@agma.org for more information and how you can participate in the annual campaign.



The American Gear Manufacturers Association (AGMA) signed a partnership agreement with Richard J. Daley College, one of the City Colleges of Chicago in April 2019, officially establishing the first AGMA National Training Center at Daley College in Chicago, IL. The AGMA National Training Center will be the center of engineering and operator level continuing education for all aspects of gear manufacturing.

The 10,000 sqft. facility will house a learning environment where more than 600 students per year will be trained and educated in gear design and manufacturing. In 2020, the AGMA National Training Center will host the majority of AGMA engineering and operator-level courses from April until November. In addition to the current gear industry and AGMA members, students enrolled in the Richard J. Daley College manufacturing or engineering programs will have the opportunity to participate in the program being offered by AGMA.



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