

2009

Modern Bearing Technology Continuing Education



STATE COLLEGE, PA • SOUTH BEND, IN
FACULTY FROM THE PENNSYLVANIA STATE UNIVERSITY AND
THE UNIVERSITY OF NOTRE DAME

 **ABMA**
American Bearing Manufacturers Association



CHAIRMAN'S INTRODUCTION



The ABMA Continuing Education Program has been an industry leader in bearing technology education and is looking to maintain that standard of excellence in 2009. Since 1995, over 1,400 managers and engineers in or related to the bearing industry have taken advantage of this highly acclaimed program.

We are proud to have a highly qualified team of professors and industry experts partnering with ABMA to lead the program. Ted Harris, from Penn State, and Tim Ovaert, from Notre Dame, are experts in their respective fields. Additionally, Dan Snyder, PE, who brings 40+ years and Mike Kotzalas, PhD,

with 15+ years of bearings industry experience round out the team. Their collective expertise, from both educational and technical perspectives, provides course participants with a well-rounded and directly applicable curriculum and learning environment.

ABMA's courses incorporate the latest in academic knowledge, as well as real world experience, which provides course participants enhanced skill sets and deeper knowledge. Additional technical experts from the various ABMA member companies also assist in delivering elements of our program.

ABMA courses are targeted to meet the needs of those working with bearings; whether as a manufacturer, supplier, distributor or end-user. In these times when ever greater results are demanded of our technical professionals, the ABMA educational courses are even more valuable to those persons responsible for rolling contact bearings.

We look forward to seeing you there.

Best Regards,



Les Miller
Engineering Education Committee Chairman
Vice President of Engineering
Kaydon Bearings Division



COURSE SCHEDULE

ADVANCED CONCEPTS OF BEARING TECHNOLOGY

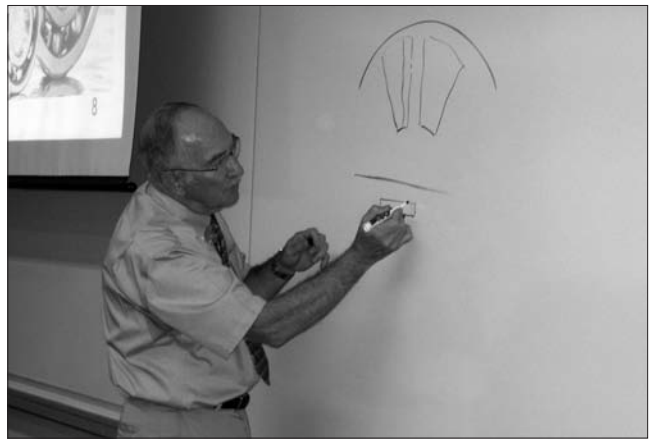
June 9-12, 2009
The Pennsylvania State University
State College, PA

LUBRICATION AND WEAR: ADVANCED CONCEPTS

July 8-10, 2009
University of Notre Dame
South Bend, IN

ESSENTIAL CONCEPTS OF BEARING TECHNOLOGY

September 15-17, 2009
The Pennsylvania State University
State College, PA





COURSE DESCRIPTIONS

Advanced Concepts of Bearing Technology

DATES: June 9-12, 2009
BEGINS: 8:00 a.m. June 9
ENDS: 12:00 p.m. June 12

LOCATION: The Pennsylvania State University,
State College, PA

TOPICS COVERED:

- Bearing Macrogeometry: Clearance, Free Contact Angle, Press Fitting
- Ball/Roller Loading: Static/Inertial
- Contact Stresses, Deflection, & Subsurface Stresses
- Internal Load Distribution
- Internal Speeds & Motions: Rolling, Sliding, Spinning
- Internal Load Distribution - High Speed
- EHD- & Micro-EHD Lubrication
- Concepts of Friction & Wear
- Statistical Analysis Methods
- Tolerances, Metrology, & Surface Topography
- Contact Friction
- Bearing Friction & Temperature
- Failure Modes
- Permanent Deformations & Static Capacity
- Vibration, Noise & Condition Monitoring
- Fatigue Life Prediction: Standard & Catalog Methods; Testing Methods; and Fatigue Limit Stress Methods
- Lubricants & Rheology
- Shaft-Bearing Systems & Performance Analysis
Computer Programs

Advanced course provides greater emphasis on examples to reinforce the technology and methods of calculation used to predict rolling bearing performance.

This course includes a copy of the book *Rolling Bearing Analysis, Advanced Concepts of Bearing Technology, 5th Edition* by Ted Harris and Mike Kotzalas (Taylor & Francis, CRCPress 2006).

FACULTY: Professors Ted Harris, Tim Ovaert & Industry Expert Mike Kotzalas

WHO SHOULD TAKE THIS COURSE? Individuals with a B.S. in engineering or a related discipline and either attendance at ABMA's Essential Concepts of Bearing Technology course or 2-3 years work experience in the bearing or related industries. Attendees receive 3.2 CEU's upon successful completion of this course.

MEMBER PRICE: \$1,875

NON-MEMBER PRICE: \$2,225



COURSE DESCRIPTIONS

Lubrication & Wear: Advanced Concepts

DATES: July 8-10, 2009
BEGINS: 1:00 p.m. July 8
ENDS: 4:00 p.m. July 10

LOCATION: University of Notre Dame,
South Bend, IN

TOPICS COVERED:

- Introduction to Lubrication and Wear
- Regimes of Lubrication
- 2-D Surface Topographical Characterization
- 3-D Surface Topographical Characterization
- 2-D (Line) and 3-D (Point) Contact Mechanics
- 2-D and 3-D Hertzian Contact Mechanics
- Surface and Subsurface Stress Analysis
- Asperity Contact Models
- Coated Surfaces
- 2-D Elastohydrodynamic Lubrication (EHL)
- 3-D EHL
- Surface Roughness Effects in EHL
- Temperature Effects in EHL
- Lubricant Starvation Effects in EHL
- Transient EHL
- Micro-EHL
- Mixed Lubrication
- Grease Lubrication, Grease Additives
- Sliding Friction
- Rolling Element Bearing Friction Torque
- Sliding Wear Models
- Fatigue Wear Models
- Debris Accommodation

- Coating Failure
- Small-Scale Phenomena
- Boundary Lubrication
- Nano-tribology
- Current and Future Research Thrusts

FACULTY: Professor Tim Ovaert

WHO SHOULD TAKE THIS COURSE? 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. The course introduces individuals to 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. Attendees receive a certificate upon successful completion of this course.

MEMBER PRICE: \$1,275

NON-MEMBER PRICE: \$1,525



COURSE DESCRIPTIONS

Essential Concepts of Bearing Technology

DATES: September 15-17, 2009

BEGINS: 8:00 a.m. September 15

ENDS: 2:00 p.m. September 17

LOCATION: The Pennsylvania State University,
State College, PA

TOPICS COVERED:

- Basic Concepts of Tribological Design
- History of Tribology and the Bearing Industry
- Rolling Bearing Types, Applications & Macrogeometry
- External & Internal Dimensional Standards
- Bearing Loads in Applications: Static Loading
- Basic Component Manufacturing Methods
- Quality Concepts & Standards (ISO 9000 & QS 9000)
- Bearing Loads In Applications: Dynamic Loading
- Mounting Methods: Shaft & Housing Fits
- Ball & Roller Loading
- Contact Stresses-Surface & Subsurface
- Bearing Load Sharing & Internal Loading
- Materials for Ball & Roller Bearings
- Introduction to Concepts in Friction, Lubrication & Wear
- Ball & Roller Bearing Deflections & Stiffness
- Lubrication Methods & Bearing Maintenance
- Failure Modes in Rolling Bearings
- Bearing Life-Standard & Catalog Calculation Methods

The course now includes a copy of the book *Rolling Bearing Analysis, Essential Concepts of Bearing Technology, 5th Edition* by Ted Harris and Mike Kotzalas (Taylor & Francis, CRCPress 2006).

FACULTY: Professors Ted Harris, Tim Ovaert & Industry Expert Dan Snyder

WHO SHOULD TAKE THIS COURSE? This course is designed for engineers and others with technical backgrounds that have limited exposure to bearings and need to either adapt their technical training to bearings or seek to upgrade their technical knowledge. The course curriculum includes quantitative and conceptual materials. Attendees receive 2 CEU's upon successful completion of this course.

COST MEMBER: \$1,475

COST NON-MEMBER: \$1,725



2009 COURSE FACULTY

Tedric A. Harris, Adjunct Professor of Mechanical Engineering, Penn State University and Consulting Engineer, State College, PA. Ted Harris holds BS and MS degrees in Mechanical Engineering from Penn State University. His industry experience includes Development Test Engineer at the Hamilton Standard Division, United Aircraft Corporation; Analytical Design Engineer at the Bettis Atomic Power Laboratory, Westinghouse Electric Corporation; and several engineering and executive management positions at SKF, including: Vice President, Engineering & Research, SKF USA and MRC Bearings (all in the USA) and Managing Director of the Engineering & Research Center in the Netherlands. He joined the Penn State faculty in 1991 and retired from full-time teaching in 2001.

Mr. Harris holds three U.S. Patents and is the author of 68 technical publications, mostly on rolling bearings. Among these is the book *Rolling Bearing Analysis*, now in its 5th edition (Taylor & Francis CRCPress - 2006). He has received outstanding technical paper awards from the Society of Tribologists and Lubrication Engineers and from ASME International. Mr. Harris is an ASME Life Fellow Member; STLE Life Fellow Member and past Chairman of the ASME Tribology Division. Recently, he received the 2007 Outstanding Engineering Alumnus from the Pennsylvania State University College of Engineering and the 2007 STLE International Award, the society's highest award.

Michael N. Kotzalas, Chief Engineer Product Design - Global TRB, The Timken Company. Mike Kotzalas holds BS, MS and PhD degrees in Mechanical Engineering from Penn State University. Since graduation in 1999, he has been employed in Product Development and Customer Engineering at The Timken Company in Canton, Ohio. Mike is an active member of technical societies, currently serving on the Executive Committee for the ASME Tribology Division. He is the author of more than 12 publications, co-author of *Rolling Bearing Analysis 5th Edition*, holds two patents on rolling bearings and has received the 2001 Best Paper Award from the ASME Tribology Division, the 2003 and 2006 STLE Hodson Award and the 2007 SAE Off-Highway Outstanding Young Engineer Award.

Timothy C. Ovaert, Professor of Mechanical Engineering- University of Notre Dame. Tim Ovaert received his BS degree in Mechanical Engineering from the University of Illinois-Urbana and his Master of Engineering Management and PhD in Mechanical Engineering from Northwestern University. His industry experience includes serving as Plant Engineer at the DuraBar Division of Wells Manufacturing Company. Previously, he was Professor of Mechanical Engineering at Penn State.

In addition to teaching mechanical engineering design, reliability engineering, and tribology, he conducts research on materials characterization, materials for tribological applications, and manufacturing. He has served as a technical consultant to more than twenty-five medium to Fortune 100 companies. He was named a National Young Investigator by the National Science Foundation, and is the recipient of the Ralph R. Teetor Award from the Society of Automotive Engineers, and the Burt L. Newkirk Award from the American Society of Mechanical Engineers (ASME). Ovaert has served as an associate editor for the *ASME Trans., Journal of Tribology*, and as the Chair of the ASME/STLE International Joint Tribology Conference. He is the author and/or co-author of over 80 technical publications, and is a Fellow of the ASME.

Dan Snyder, Former Director of Application Engineering for SKF USA Inc's Industrial and Service Divisions. Mr. Snyder is a Registered Professional Engineer with over forty five years of experience in the bearings and related components and services fields. He has extensive experience in the areas of design, application, life analysis, lubrication, testing and failure analysis of rolling element bearings. Mr. Snyder is the author of various technical publications and industry trade publication articles. He has worked on various ISO Working Groups for rolling bearings and currently is a member of the ABMA Bearing Technical and the Education Committees. He is also a member of the American Society of Mechanical Engineers and the Society of Tribology and Lubrication Engineers. Currently, Mr. Snyder is President of his own consulting business, Bearing and Lubes Consulting, LLC.



ACCOMMODATIONS INFORMATION

Housing costs are not included in course fees and participants are responsible for making their own housing arrangements. Please identify yourself as an ABMA course participant when making reservations in order to receive the discounted ABMA room-rate. Reservation cut-off dates for each course is listed below. Please secure reservations by the deadline listed to ensure availability of rooms. After these dates, the rooms will be released to the general public and ABMA cannot guarantee hotel availability or the special ABMA group rate.

ADVANCED CONCEPTS OF BEARING TECHNOLOGY & ESSENTIAL CONCEPTS OF BEARING TECHNOLOGY

COURSE LOCATION AND ACCOMMODATIONS

These courses will be held at The Penn Stater Conference Center Hotel, one of the largest university-based conference center hotels of its kind in the country.

A block of rooms has been reserved at the Penn Stater Conference Center Hotel for course participants for the evenings of June 8-11th for the Advanced Course and the evenings of September 14-16 for the Essentials Course. The special ABMA rate is \$109 single occupancy/\$119 double occupancy, plus hotel occupancy tax.

Participants must make lodging arrangements 30 days prior to course in order to be guaranteed housing at The Penn Stater at the ABMA rate (by May 9 for the Advanced Course and by August 15 for the Essentials Course.) After this date, the room block will be released and ABMA cannot guarantee availability or the ABMA special rate.

To make reservations, please call 1-800-233-7505 or (814) 863-5000 and refer to Reservation Code ABMF09A for the Advanced Course and ABMAI09A for the Essentials Course when making reservations. Check-in time is 3:00 pm and check-out time is noon. As a reminder, all course attendees are responsible for booking their hotel room.

The Penn Stater Conference Center Hotel

Phone: 800-233-7505 or 814-863-5000

Fax: 814-863-5002

Website:

<http://www.pshs.psu.edu/pennstater/pshome.asp>

For a listing of other hotels,

please visit: <http://www.visitpennstate.org/>

TRANSPORTATION

State College/University Airport (SCE) is located six miles from the course site. Delta Connection, US Airways Express, Northwest AirlinK, and United Express serve the State College/University Park Airport and connections can be made through Washington-Dulles (IAD), Philadelphia (PHL), Cincinnati (CVG), and Detroit (DTW). Be sure your final destination is SCE.

Shuttle transportation from the airport to The Penn Stater Conference Center Hotel can be arranged by using the courtesy phone near baggage claim.

Alternatively, Pittsburgh and Philadelphia International Airports are located approximately 3 hours from Penn State and rental cars are available at each location.

Driving Directions to Penn Stater Conference Center Hotel:

From New York City and the East:

Take I-80 W in PA to Exit 161 (Bellefonte). Follow PA 26 S to US 220 S, and take Exit 74 for Innovation Park/Penn State University. Stay in the right lane of the exit and follow the sign for Innovation Park. Turn right at the end of the ramp onto the Park Avenue extension, and turn left at the stop sign onto Innovation Boulevard. The Hotel is on the right.

From Philadelphia:

Take the PA Turnpike/I-76 W to Exit 247 (Harrisburg East), and follow signs for the next 15 miles to Route 322 W. Take 322 W past Lewistown toward State College (staying on 322 W at Boalsburg), and take the Penn State University/Innovation Park Exit. Turn left at the stoplight, and follow signs for Innovation Park Exit A directly to the Hotel in Innovation Park.



ACCOMMODATIONS INFORMATION

From Harrisburg:

Take 322 W past Lewistown toward State College (staying on 322W at Boalsburg), and take the Penn State University/Innovation Park Exit. Turn left at the stoplight and follow signs for Innovation Park Exit A directly to the Hotel in Innovation Park.

From Pittsburgh:

Take Route 22 E to Duncansville. Merge onto Route 220/I-99 N toward Altoona and go north for 55.4 miles. Turn right onto US 220 toward State College for 11.5 miles; merge onto Route 322 E to State College. Stay on Route 322 and later the 322 E/US 220 N bypass to the Penn State University/Innovation Park Exit. Turn left at the stoplight, and follow signs for Innovation Park Exit A directly to the Hotel in Innovation Park.

From the West:

Take I-80 E in PA to Exit 161 (Bellefonte). Follow PA 26 S to US 220 S, and take Exit 74 for Innovation Park/Penn State University. Stay in the right lane of the exit and follow the sign for Innovation Park. Turn right at the end of the ramp onto the Park Avenue extension, and turn left at the stop sign onto Innovation Boulevard. The Hotel is on the right.

LUBRICATION & WEAR: ADVANCED CONCEPTS

COURSE LOCATION AND ACCOMMODATIONS

This course is held at the Center for Continuing Education Building on the Notre Dame campus.

A block of rooms is reserved at the Morris Inn across Notre Dame Avenue from the Continuing Education Building at the University of Notre Dame.

Participants must make lodging arrangements at least 30 days prior to the start of the course in order to be guaranteed housing at the Morris Inn at the ABMA rates. To receive the discounted rate, call 574-631-2000 and identify yourself as an ABMA course attendee. Per night rates are \$132 for a single and \$152 for a double plus 13% tax. Check-in time is

3:00 p.m. and check-out is noon. Parking at the Morris Inn is free for registered guests. As a reminder, all course attendees are responsible for booking their own hotel room.

The Morris Inn

Notre Dame Avenue

Phone: 574-631-2000

<http://morrisinn.nd.edu/>

An alternate option for lodging is The Inn at St. Mary's, 574-232-4000, located less than a mile from Notre Dame. The Inn at St. Mary's offers scheduled shuttle service to and from Notre Dame's campus.

<http://www.innatsaintmarys.com>

TRANSPORTATION

Airline service to South Bend's Regional Airport (SBN) is provided primarily by commuter lines of major air carriers through Chicago O'Hare (United), Detroit (Northwest), Cincinnati (Delta), Atlanta (Delta), Cleveland (Continental), Minneapolis/St. Paul (Northwest), Las Vegas (Allegiant), and St. Petersburg, FL (Allegiant).

The campus is easily accessible from the airport by a short taxi ride. Frequent limousine service is also available directly to the campus from Chicago's O'Hare and Midway Airports via Coach USA (800-833-5000 or www.busville.com).

South Bend is also served by the interurban South Shore Railroad from downtown Chicago and by AMTRAK trains, east and west, daily.

If you are driving, Notre Dame is located in South Bend, Indiana, about 90 miles east of Chicago, near the Indiana Toll Road (Interstate 80/90). Exit 77 (Notre Dame) is 1 mile from campus.



ON-SITE INFORMATION

ON-SITE INFORMATION

All courses include continental breakfast, lunch and coffee breaks.

COURSE CONFIRMATIONS

Before the start of the course, ABMA will send confirmation via e-mail verifying receipt of your registration and confirming your participation in the program. All course books & materials will be distributed on-site.

CREDIT CARD TRANSACTIONS

Before charging the registration amount to your or your company's credit card, please verify if there is a limit on the card that restricts large purchases as to avoid your card being declined. If there is a limit, please indicate that you would like the charge to be broken up into two separate transactions, so that we may process your registration in a timely manner.

SUBSTITUTION AND CANCELLATION POLICY

Substitutions for registrants unable to attend will be accepted any time prior to the beginning of the course. We do ask however, that any course-related materials already received by the registrant be forwarded to the substitute attendee.

Cancellations received 60 days prior course start date will receive a full refund. Cancellations received between 30 days and 60 days from the start of the course will receive a 50% refund. There are no refunds for cancellations within 30 days of course start date. **Again, substitutions are welcome and strongly recommended.**

2009 MODERN BEARING TECHNOLOGY CONTINUING EDUCATION
REGISTRATION INFORMATION



Please use a separate form for each attendee

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

PHONE _____ FAX _____ EMAIL _____

ADVANCED CONCEPTS OF BEARING TECHNOLOGY

June 9 - 12, 2009 – State College, PA

Early Registration Member: \$1,685.00 Non-Member: \$2,000.00
Regular Registration Member: \$1,875.00 Non-Member: \$2,225.00

LUBRICATION AND WEAR: ADVANCED CONCEPTS

July 8 - 10, 2009 – South Bend, IN

Early Registration Member: \$1,150.00 Non-Member: \$1,375.00
Regular Registration Member: \$1,275.00 Non-Member: \$1,525.00

ESSENTIAL CONCEPTS OF BEARING TECHNOLOGY

September 15 - 17, 2009 – State College, PA

Early Registration Member: \$1,350.00 Non-Member: \$1,575.00
Regular Registration Member: \$1,475.00 Non-Member: \$1,725.00

EARLY REGISTRATION DISCOUNT

Early Bird Discount

Register at least 60 days prior to the start of the courses you choose and enjoy a 10% discount on registration fees.

Advanced Concepts

Register by April 11

Lubrication and Wear Concepts

Register by May 10

Essential Concepts

Register by July 1

METHOD OF PAYMENT

Check Visa MasterCard American Express Discover

NAME OF CARDHOLDER CARD NUMBER EXPIRATION DATE

TOTAL \$ _____ **COMPANY MEMBER OF ABMA:** YES NO

REGISTRATION IS BASED ON A FIRST-COME, FIRST-SERVED BASIS BASED ON AVAILABILITY. REGISTRATION FEE INCLUDES CLASS SESSION, COURSE MATERIALS, AND FOOD FUNCTIONS.

MAIL: Mail your registration & payment to: ABMA, 2025 M St. NW, Suite 800, Washington, DC 20036

FAX: Fax your registration and credit card information to ABMA at (202) 367-2155.

SUBSTITUTION AND CANCELLATION POLICY

Substitutions for registrants unable to attend will be accepted any time prior to the beginning of the course. We do ask however, that any course-related materials already received by the registrant be forwarded to the substitute attendee. **Substitutions must be submitted in writing to ABMA.** Cancellations received 60 days prior course start date will receive a full refund. Cancellations received between 30 days and 60 days from the start of the course will receive a 50% refund. There are no refunds for cancellations within 30 days of course start date. **Again substitutions are welcome and strongly recommended.**

HOTEL POLICY

Participants must make their lodging arrangements at least 30 days prior to the start of the course in order to ensure that rooms are available at the contracted rate.

For further information, contact ABMA at (202) 367-1155 or at info@americanbearings.org.

ABOUT ABMA

The American Bearing Manufacturers Association (ABMA) is a trade association, open to any firm with a substantial part of its business being the manufacture, in the United States, of anti-friction bearings or major components thereof. ABMA actively strives to promote and grow the bearing industry through member programs - conferences, national and international standards, industry statistics and bearing technology courses. ABMA monitors and informs members of global trade issues, regulatory actions and legislative matters impacting the bearing industry's commercial viability. ABMA member companies manufacture over 80% of the bearings produced in the United States. For further information about ABMA visit www.americanbearings.org.

ABMA STANDARDS

American Bearing Manufacturers Association has published a complete set of Standards for anti-friction ball and roller bearings and balls. These Standards were prepared by ABMA's Bearing Technical Committee and have received the approval of the participating companies as well as the American National Standards Institute (ANSI) and/or the International Standards Organization (ISO).

To purchase ABMA standards or for more information, visit us on line at www.americanbearings.org/publications. ABMA standards cover a wide range of bearing types and topics. Our standards encompass, but are not limited to:

Airframe Ball Bearings, Ball bearings, Cylindrical Roller Bearings, Instrument Ball Bearings, Linear Bearings, Radial Bearings, Roller Bearings, Spherical Plain Bearings, Tapered Roller Bearings, Thrust Bearings, Roller Bearing Mounting Accessories, Spherical Roller Bearing, Needle Roller Bearing, Ball Roller Bearing, Cam Bearing Roller, Taper Roller Bearing, Flanged Roller Bearing, Radial Ball Bearings and Roller Thrust Bearing.

Register Today
www.americanbearings.org/education



2025 M Street, NW
Suite 800
Washington, DC 20036
Phone: 202-367-1155
Fax: 202-367-2155
Email: info@americanbearings.org
Website: www.americanbearings.org