



TRIBOLOGY

Tribology Division Newsletter

Steven R. Schmid, Editor

Fall 2002

Chair's Message



Harvey Nixon

The Tribology Division remains a strong, viable and active Division of ASME. Membership has been stable for many years; the finances are in excellent health and the envy of many other

ASME Divisions. We owe a large debt of appreciation to those who served the Division in the past and have left us in our current state. We will continue to explore ways to serve the world tribology community better and fulfill the goals in our bylaws, thereby maintaining our success.

The "winds of change are always blowing", and currently the Council On Engineering (COE) and the Basic Engineering Technical Group are considering changes in the organizational structure that might better benefit the ASME membership at large. The latter is the organization to which the Tribology Division is accountable within ASME and we look forward to contributing our recommendations of changes and to the positive effects this can have for our Division.

There are many other like-minded groups and societies who are also active in the disciplines related to tribology. We want to insure close collaboration so that all these efforts achieve the goals of all. Sharing of ideas, interests and developments within the larger community is critical in achieving the Division's goals. To

this end, the ASME Tribology Division and the Society of Tribologists and Lubrication Engineers (STLE) jointly sought and were selected by the International Tribology Committee (ITC) to organize the 2005 World Tribology Congress (WTC) in Washington, D.C. The planned dates for this have been slated to be September 12th thru 16th, 2005. The preliminary organizational work for the conference is underway. Rick Cowan and John Tichy as well as many others will represent the ASME Tribology Division on the conference oversight committee. TD members who attended the previous conferences in London and Vienna can attest to the fact that this event is the premier world gathering of tribologists, and we are very excited to be jointly hosting the World Tribology Congress in the United States. However, we recognize that this will be a challenge, and we will depend on all members of the Executive Committee and the membership of the Tribology Division for assistance.

Both ASME and STLE will seek close collaboration and involvement of the various tribology organizations throughout the world to insure a successful conference.

Our International Joint Tribology Conference in 2001 was held in San Francisco, CA from October 22-24. Even though the effects of the terrorist attacks of September 11, 2001 could still be felt, the conference was still successful. We attribute this to the extraordinary dedication of our members to the science of tribology and to lifelong learning as well as the outstanding reputation of the Joint Tribology Conference.

International Joint Tribology Conference

October 27-30, 2002
Cancun, Mexico
Moon Palace Resort

"An international exchange of state-of-the-art knowledge pertaining to engineering practice in research, development, manufacturing, application and teaching of the science and technology of tribology."

Sponsors:

ASME International, Tribology Division and The Society of Tribologists and Lubrication Engineers (STLE)

Cooperating Societies:

The Japan Society of Mechanical Engineers (JSME) and the Japanese Society of Tribologists (JAST).

For further information, please visit <http://www.asme.org/conf/trib02/>

(continued on page 2)

Chair's Message

(continued from page 1)

This year's International Joint Tribology Conference will be held in Cancun, Mexico, from October 27-30, 2002. Hugh Spikes of Imperial College (London) is the conference chair, and he recommended the Cancun site after a thorough search. He proposed this site as consistent with the Division's desires to provide a premier conference at an interesting location for reasonable cost. I certainly commend him, because the conference site is extremely attractive, the facilities are outstanding, and the cost is very low for technical conferences of this caliber.

We continue to maintain our established strengths of technical excellence in publications, conferences, education and service to members. Our Executive Committee meetings are held at the Joint ASME/STLE Tribology Conference (Cancun in October this year) and at the STLE Annual meetings in May of each year. These meetings are open to all interested ASME members.

My appreciation is extended to the Executive Committee members as well as others who are active in the various Division committees. You have made this year a success for your Division. Please keep up the good work.

As you read the reports from the various committees, enclosed in the newsletter, please share with us your thoughts on how the Division might be of further service to you and others. We welcome your thoughts and most of all we welcome your involvement in committee activity, volunteer some time for advancing our profession.

Harvey Nixon

ASME and STLE to Host WTC 2005

The Society of Tribologists and Lubrication Engineers (STLE) and the American Society of Mechanical Engineers (ASME) prepared and presented a bid to host the 2005 World Tribology Congress in Washington, D.C. As the nation's capital, Washington, D.C., is the appropriate site for the WTC, since the prior two Congresses have been held in the capital city of the host country: London (1997) and Vienna (2001).

The ASME/STLE bid was approved during the Vienna World Tribology Congress, and organization efforts are underway. The Tribology Division is proud and excited to play a lead role in this prestigious conference. ASME representatives to the oversight committees are *Rick Cowan* and *John Tichy*.

Honors and Awards

The **Mayo D. Hersey Award** is the highest Tribology honor given by ASME. It is awarded annually to a person who has made distinguished and continued contributions over a substantial period of time to the advancement of lubrication science and engineering. The 2001 Hersey Award winner is *Said Jahanmir*, National Institute of Standards and Technology.

The **Burt L. Newkirk Award** is given to an individual under the age of 40 who has made a notable contribution of research and/or development as evidenced by publications advancing the field of tribology. The 2001 Newkirk Award was presented to *Andreas Polycarpou*, University of Illinois.

The editor and associate editors of the *Journal of Tribology* select the best paper that appears in the *Journal* each year. The paper selected as **Best Paper of 2001** is "Fatigue Failure Progression in Ball Bearings," by *Michael N. Kotzalas* and *Tedric A. Harris*, 123, pp. 238-243.

The Research Committee on Tribology presented an **Innovative Research Award** to "Y.W. Chung" and L.M. Keer of Northwestern University for their work involving superlattice coatings.

International Coordination

The International Coordination Committee (ICC) has established "Regional Committees" to more effectively coordinate international activities and promote collaboration among the international ASME TD members. To date, Prof. *Jean Frene* from the University of Poitiers in France has agreed to lead the European Region, and Prof. *Kuniaki Dohda* from Gifu University in Japan will lead the Asian and Pacific Rim region. We are actively pursuing members to lead the South America, Middle East and Africa, and Australia and New Zealand Committees.

In addition, Prof. *Bo Jacobson* of Lund Institute of Technology in Sweden has been working to inform TD members of future Tribology activities and international conferences on the TD web page.

David Brewster, Chair

Education

The Education Committee was charged with identification of various education products that would be of interest to the membership of the Tribology Division. A preliminary list was submitted to the Executive Commit-

tee, and included: (a) Development of introductory one-hour videotapes concerning tribology fundamentals; (b) Development of three-hour tutorials on topics of current interest; (c) Organization of one-day workshops on topics such as friction and wear effects on machine elements, or standards and codes; (d) Develop a series of tribology lectures on selected topics covering both fundamental and practical aspects. This would involve several experts from the tribology community; (e) Development of several one-day courses that can be offered bi-annually on new topics.

A tribology survey is being prepared and will be sent to the membership to determine the state of tribology education.

Kyriakos Komvopoulos, Chair

Technical Expositions

The Technical Expositions Committee was charged to examine the revised "Conference Rules and Operating Guide" that govern the annual International Joint Tribology Conferences (IJTC), and offer suggestions to the Executive Committee (EC) of the Tribology Division for approval. The TEC first discussed the existing and revised rules in a meeting during the STLE-ASME conference in San Francisco (October 2001). Since then, input was obtained from the committee members as well as several other people.

The existing Conference Rules and Operating Guide was reviewed extensively, and a number of changes were recommended for consideration by the Executive Committee. Most of these recommendations concerned rewording of rules to reflect changes in the structure of the Conference Planning Committee. However, recommendations concerning important issues such as incorporation and organization of one-day symposia at conferences was discussed.

Andreas Polycarpou, Chair

Limerick for a Tribologist

A daring young student of Tabor
On friction spent much time and labor
Now he's red as a beet
From the frictional heat
'Cause he published the work of his
neighbor

*Submitted by Prof. J.T. Black,
Auburn University*

Journal of Tribology Editor

During the past year, the ASME *Journal of Tribology* has maintained its position as one of the world's most respected archival journals in the field of tribology. Obviously, I am a prejudiced observer. However, various citation indices notwithstanding, I believe we are viewed as the best journal in the field by the U.S. engineering community. Certainly, we are the most popular publication venue. We may have viable overseas competitors from the science perspective. I wish to extend my appreciation to the authors, Associate Editors, and reviewers who have contributed to the *Journal's* success.

The distribution of papers per subject matter in the *Journal* has varied only slightly during the past six years, as follows:

SUBJECT	DISTRIBUTION					
	00-01	99-00	98-99	97-98	96-97	95-96
Friction/wear/contact mechanics	30	30	26	23	28	29
Hydrodynamics (including gas)	22	28	27	21	26	22
EHL/rolling elements	17	12	12	18	18	18
Magnetic storage	18	20	17	18	14	13
Other (including seals, coatings, molecular, manufacturing)	13	10	18	20	14	18

In many cases, the assignment of a paper to one category or another is fairly arbitrary: a gas bearing paper could be "hydrodynamics" or "magnetic storage," an adhesion paper could be either "contact mechanics" or "other," etc. The range of type of papers in the "other" category is huge: from our most scientific papers on, say, molecular nanotribology; to the most applied papers on, say, wear in forming processes. Likewise, the range of type of paper in the Friction/wear/contact mechanics category is large - from highly empirical in the wear field, to highly mathematical in contact mechanics.

As mentioned in the last Newsletter, I encourage perspective authors to submit Technical Briefs. Typically, they are about half the size of a normal journal article, about 3,500 words. Briefs do not need to exhibit "permanent value", a necessary condition for normal journal papers. I plan to publish them in a more timely fashion, appearing in the *Journal* as soon as they are typeset and proofed.

Again, I am always interested in comments and suggestions and how we can best serve those who are doing, and using research work in tribology. I can be reached at tichyj@rpi.edu

John Tichy, Technical Editor

Editor's Note: Finances Reasonable for IJTC 2002

At first glance, one may not realize this, but the conference and hotel fees are all-inclusive, that is, all meals, beverages, hotel taxes and fees, transportation to and from the airport, and sports and water sports facilities are all included in the conference room rates of \$224.00 for singles, \$261.00 for double occupancy per night. It may sound like Cancun is a bit too luxurious for a conference, but the truth is that this conference offers an impressive scientific program at a very reasonable cost.

Tribology 2002 Fellows List

David E. Brewé
US ARMY AIR PROPULSION LAB
Brunswick, Ohio

Andrew Jackson
EXXON MOBIL RESEARCH & ENGRG
Pennington, NJ

ANNOUNCEMENT AND INVITATION

Frontiers of Magnetic Hard Disk Drive Tribology and Technology

**Cancun, Mexico,
October 28-30, 2002**

Organized by the Magnetic Storage Committee of the Tribology Division of ASME

The technical areas of interest are tribological and micro-nanotechnology issues related to magnetic hard disk drives associated with higher recording densities. Subjects of particular interest are:

- Tribology, Microtribology, and Nanotribology of the Head disk Interface
- Contact-Flyability Issues at Ultra Low Fly-Heights
- High Tracks Per Inch: Servo-Mechanical Design, Micro-Actuation
- Tribomaterials
- Thermal Asperities
- High RPM Challenges
- Perpendicular Recording
- Patterned Media
- Spindle and Motor Design

However, other areas appropriate to the conference theme are welcome.

In addition to the contributed papers/presentations, the one-day Symposium will also include a presentation honoring Professors David B. Bogy, UC-Berkeley and F.E. Talke, UC San Diego, for their substantial life-long contributions to advancement of the knowledge of tribology of Magnetic Storage Devices.

Among the invited speakers are: Fu-Ying Huang, IBM Almaden, Norio Tagawa - Kansai University, Japan, Junguo Xu - Hitachi (MERL) Yiao-Tee Hsia - Seagate, Yasunaga Mitsuya - Nagoya University, Japan and Jing Gui - Seagate.

To contribute, please contact one of the organizers

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Technical Committee Reports

Research Committee on Tribology

The Research Committee on Tribology met during the ASME/STLE Joint conference at San Francisco in October 2001, and the STLE conference at Houston in May 2002. Officers for 2001-2002 were Chair Professor Michael D. Bryant of University of Texas at Austin, Vice-Chair Dr. Christopher DellaCorte of NASA Glenn Research Center, and Secretary Dr. Nelson Foster of AFRL/PRSL, Untied States Air Force. Current member include Dr. Ali Erdemir of Argonne National Laboratories, Professor Thierry A. Blanchet of Rensselaer Polytechnic Institute, Professor Timothy C. Ovaert of University of Notre Dame, Professor Farshid Sadeghi of Purdue University, Professor Luis San Andres of Texas A&M University, Professor Q. Jane Wang of Northwestern University, and Past Chair Dr. Hooshang Heshmat of Mohawk Innovative Technologies.

The Research Committee on Tribology conducted a Workshop on "Tribology Issues in Biology & Medicine", December 10-12, 2001, at Argonne National Laboratories, outside of Chicago. The workshop committee included chair M.D. Bryant of University of Texas at Austin, T. Blanchet of Rensselaer Polytechnic Institute, A. Erdemir of Argonne, T. Ovaert of University of Notre Dame, J. Wang of Northwestern University, and G. Fenske of Argonne. This workshop had goals: 1. Overview existing areas of tribology research in biology and medicine, and recommend direction, and 2. Identify NEW areas for research. Areas explored included joint wear, replacement, and lubrication; dental contact and wear; heart valves and blood pumps; and miscellaneous topics. New areas will seek tribology research issues in anatomy, physiology, medical equipment, and other areas of medicine, especially with respect to degenerative conditions. Such issues could arise in cell structure, organ transplants, artificial organs, eye-ear, nose and throat, cardiopulmonary, etc. A workshop report is available at <http://www.me.utexas.edu/~bryant/Bio-Trib-Workshop/Report.pdf>

A second workshop "Virtual Machine Design" is tentatively planned at Purdue University in spring 2003. Organizers are Dr. Nelson Forster and Prof. Farshid Sadeghi. This workshop will examine issues related to computer modeling to support design of systems, especially those with tribological components. Stressed will be computer modeling methods, device models, and linking of codes.

Currently, RCT is drafting a set of bylaws to guide its operation, under Dr. Chris Dellacorte's lead. Prof. T. Ovaert of the University of Notre Dame has been

selected as the chair of the RCT for 2002. Prof. Ovaert will survey and report on research opportunities in Dry Machining, and manufacturing, especially machining without lubricants.

Michael Bryant, Chair

Life Ratings for Modern Rolling Bearings

The Technical Committee on Life Ratings for Modern Rolling Bearings is in the final stages of publishing a Design Guide to calculate the integrated stress-life factor for bearing life ratings. The intent of the Design Guide is to provide a common methodology for calculating bearing life, containing the most recent technology in a consistent user-friendly format. The methodology is directly applicable to the new ISO 281 standard published in February 2000. Key members of the committee conducted a symposium in March 2002, sponsored by the American Bearing Manufacturers Association, where they presented a summary of the Design Guide and its associated computer program to users throughout the bearing industry. The Design Guide addresses competing surface and subsurface failure modes, lubrication and contamination effects and material fatigue stress limits, for all the common types of ball and roller bearings. Final correlation of the computer program is currently underway over a wide range of service applications. For additional information on this effort, please contact Roger Barnsby at barnsbrm@pweh.com.

Roger Barnsby, Chair

Predictive Maintenance Technology

William D. Marscher of Mechanical Solutions, Inc., Parsippany NJ, Chairman of the ASME Predictive Maintenance Committee of the Tribology Division reports that the committee has been very active during the past year. Included in the PdMT Committee activities over the last year were a special symposium at the COMADEM Conference in Houston, TX just before Christmas, in which university research and technology laboratories presented activities and opportunities to a large audience of potential collaborators and end-users of condition monitoring and predictive maintenance technologies. An in-depth discussion between the presenters and the audience followed the presentations. The session was organized by William Marscher of Mechanical Solutions, Inc., and was chaired by Richard Cowan of Georgia Tech.

The committee also participated in several joint activities with the Society of Tribologists & Lubrication Engineers. The PdMT Committee organized a short course for the CM2002 Symposium in Dallas TX in Feb. 2002, at which Committee Vice Chair Carl Byington of Impact Technologies LLC, Committee Secretary Richard Cowan, and Committee Chair William Marscher each presented lectures on new technology development in the PdM area. At the STLE Annual Meeting in May in Houston TX, the PdMT committee co-organized three machinery reliability sessions, in collaboration with the STLE Mechanical Seals Technical Committee. This included panel/ discussion groups with the different perspectives of the equipment OEM's, the End-Users, and the consultants/ troubleshooters. Ideas which the committee is pursuing for the remainder of 2002 include electronic education (tapes, web-casting), special publications, magazine articles, and increasing the tempo on a committee membership drive. In addition, it is hoped that cooperation can be increased with other ASME Divisions and their Committees, including the Power and Process Divisions, and the IGTI.

Magnetic Storage

The Magnetic Storage Technical Committee of the Tribology Division has been very active since its establishment three and a half years ago. In the past year or so, the magnetic storage industry has been shrinking, so that the Magnetic Storage Symposium at the 2001 Joint Conference had lower attendance than previous years. Nevertheless, the symposium was considered to be a success as it is now established as a premiere event of magnetic storage tribology.

For this year's Joint Conference (2002 Cancun), we are planning a one-day symposium during the conference, as has been approved by the Conference Planning Committee. The symposium is entitled "Frontiers of Magnetic Hard Disk Drive Tribology and Technology". All invited talks and extended abstracts will be published into a proceedings volume by ASME. New members Dr. Mike Suk of IBM and Dr. Yiao-Tee Hsia of Seagate Research are co-organizers of the Symposium in Cancun.

This past year we have been investigating potential additional events to attract more magnetic storage researchers. This involves organizing specialized workshops and symposia, most likely co-organized with societies such as the National Storage Industry Consortium.

C. Singh Bhatia, Chair
Andreas Polycarpou, Secretary

Technical Brief: Tribology in Biology and Medicine

The Research Committee on Tribology (RCT) convened a workshop "Tribology Issues in Biology and Medicine" at Argonne National Laboratories, December 10-12, 2001. The continuing push to improve medical practice and patient well-being is impacted by the ability to identify, predict, distribute, and control forces and loads in medical equipment, biological structures, and cells. This ability is often limited by contact, friction, lubrication, and wear. Current and past bio-tribology research has included study of contact, wear, lubrication, and materials for replacement joints, teeth, heart valves, blood pumps, lenses, and catheters, among others. Medical issues have focused on materials and design for replacement parts and supportive medical equipment. This workshop had the following principal goals:

- Overview existing areas of research and recommend direction
- Identify new areas for research

Recommendations, duly prioritized, are reported in <http://www.me.utexas.edu/~bryant/Bio-Trib-Workshop/Report.pdf>, a brief summary of which is contained here.

Orthopedic Tribology Recommendations

1. An improved understanding of tribology of natural synovial joints, including

native, regenerated, and replacement tissues for these joints is needed.

2. Improved characterization of in vivo wear of prosthetic joints, including monitoring wear before failure occurs, wear particle characterization, and extension to other joints is essential.
3. Research should be conducted to obtain a better understanding of kinematics of both natural and prosthetic joints, to improve in vitro wear simulation and design of prosthetic joints.
4. In vivo wear mechanisms of prosthetic joint materials need to be more thoroughly investigated.
5. Further research should be directed towards novel engineered materials for joint implants: ceramic-on-ceramic/metal-on-metal/surface engineered materials etc.

Cardiovascular Tribology Recommendations

1. Special coatings for catheters, wires, etc., to expedite delivery through blood vessels of devices such as stents and balloons should be developed.
2. Improved and bio-compatible lubricants should be designed to include an anti-proliferative agent, mimic the functions of real bio fluids, and reduce

friction and heat in tortuous vessels, for catheters and atherectomies.

3. Artificial heart applications require coatings to avoid clotting, such as autologous cell coating
4. Variable flow and/or Ventricular Assist Pumping devices may be designed as blood pumps to minimize distal limb ischemia and lower the risk of hemolysis
5. Micro-electronic-mechanical systems (MEMS) are needed for percutaneous use to sense, measure, and repair systems.

Dental Tribology Recommendations

1. A better fundamental understanding of wear mechanisms in a fluid environment with fatigue and aging is required.
2. The kinematics of chewing/tooth contact including TMJ kinematics should be studied.
3. Sensors are needed (in-vivo, multi-functional small, dynamic, multi-axial) to measure motions and forces.
4. Multifunction coatings for the oral environment should be developed.
5. Research efforts should be directed towards proper simulation of the fluid environment, including tribo-chemical concerns

Michael Bryant, University of Texas

Tribology Division 2002-2003

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ASME/STLE International Joint Tribology Conference 2002

Program at a Glance

To view the full technical program visit the web site at <http://www.asme.org/conf/trib02/techprog/index.htm>

Monday, October 28, 2002

8:30 am–12:00 pm	Session 1A: Machine Components—I Session 1B: Tribology Fundamentals I: Surface and Contact Phenomena—I Session 1C: Elastohydrodynamic Lubrication—I Session 1D: Fluid Film I: Numerical Solutions and Optimization Session 1E: Symposium on Magnetic Storage—I Session 1F: CEI Course: Vibration Analysis in Rotating Equipment and Predictive Maintenance (starts at 9:00am)
10:00 am–10:30 am	BREAK
12:00 pm–1:30 pm	LUNCH
1:30 pm–5:00 pm	Session 2A: Machine Components—II Session 2B: Tribology Fundamentals II: Surface and Contact Phenomena—II Session 2C: Elastohydrodynamic Lubrication—II Session 2D: Fluid Film II: Thrust and Journal Bearings Session 2E: Solid Lubricants—I Session 2F: Symposium on Magnetic Storage—II
3:00 pm–3:30 pm	BREAK

Tuesday, October 29, 2002

8:30 am–12:00 pm	Session 3A: Machine Components—III Session 3B: Tribology Fundamentals III: Lubrication Session 3C: Fluid Film Tribology—I Session 3D: Magnetic Storage Tribology—I Session 3E: Panel on Wear and Contact Damage in Ceramics
10:00 am–10:30 am	BREAK
12:00 pm–2:00 pm	AWARDS LUNCHEON
2:00 pm–5:00 pm	Session 4A: Machine Components—IV Session 4B: Metalworking Tribology Session 4C: Fluid Film Tribology —II Session 4D: Magnetic Storage Tribology—II Session 4E: CEI Course: Vibration Analysis in Rotating Equipment and Predictive Maintenance
3:00 pm–3:30 pm	BREAK

Wednesday, October 30, 2002

8:30 am–12:00 pm	Session 5A: Lubricants—I Session 5B: Tribology Fundamentals IV: Wear—I Session 5C: Fluid Film Tribology —III Session 5D: Nanotribology Session 5E: CEI Course: Vibration Analysis in Rotating Equipment and Predictive Maintenance (starts at 9:00am)
10:00 am–10:30 am	BREAK
12:00 pm–1:30 pm	LUNCH
1:30 pm–5:00 pm	Session 6A: Lubricants—II Session 6B: Tribology Fundamentals V: Wear—II Session 6C: Solid Lubricants—II (will end at 5:30 pm)
3:00 pm–3:30 pm	BREAK