

Number 7, April 1989

Editor: Fred S. Hickernell



Richard M. White Distinguished Lecturer Achievement Award Winner **Take Note in This Issue**

Frequency Control Symposium Denver, May 31 - June 2

Distinguished Lecturer Program

Awards

Chapter Activities

New UFFC-S Members

Transactions Alert

Ultrasonics Symposium Montreal, Oct. 3 - 6

43rd Annual Frequency Control Symposium

The 43rd Annual Symposium on Frequency Control will be held on May 31 - June 2, 1989. The site for this years symposium will be the Marriott Hotel City Center in Denver, Colorado.

The number of summaries submitted to the technical program committee reached an all time high. The quality of these submissions proves to make the 43rd the best symposium ever. Ninety papers will be presented in 21 sessions. Highlights will be a specially organized session on environmental effects and their measurement, a session on surface preparation of quartz, including a tutorial on abrasive processes, and a session on two-way time transfer.

The symposium will begin with a plenary session at which three prestigious awards will be presented. The Cady award is presented annually by the technical program committee to recognize outstanding contributions related to piezoelectric frequency control devices. This year the award recipient will be Dr. D. E. Newell. The Rabi award is presented to recognize outstanding contributions related to fields such as atomic and molecular frequency standards, time transfer, and frequency and time metrology. This year's recipient is Dr. L. Cutler. The third award, sponsored by Sawyer Applied Research Products, is presented in honor of C. B. Sawyer for the most outstanding recent contribution to advancement in the field of quartz crystals and devices. The recipient of the C. B. Sawyer award is selected by an independent committee and will be

Special invited presentations will include "Spacecraft Gravitational Wave Experiments" by J.W. Armstrong, JPL; "Shear Mode Grinding" by N.J. Brown and B.A. Fuchs, LLNL; A High Stability Microwave Oscillator Based on a Sapphire Loaded Superconducting Cavity" by D.G. Blair, A.J. Giles, and S.K Jones, U. of Western Australia; "Stacked Crystal Filters Implemented with Thin Films" by K.M. Lakin, G.R. Kline, J.T. Martin, and K.T. McCarron, Iowa State U.; and "Low-Cost High-Performance Resonator and Coupled-Resonator Designs: NSPUDT and Other Innovative Structures" by P.V. Wright, RF Monolithics.

The social program will be extra special due to the proximity of the National Institute of Science and Technology (formerly the National Bureau of Standards). There will be a tour of NIST, including a visit to the nation's time standard, tentatively scheduled for Wednesday evening, May 31. Dinner on Thursday, June 1, will be at a famous Denver attraction The Fort. The Fort is a restaurant specializing in authentic foods of the American West including buffalo, Rocky Mt. Oysters and Rocky Mt. Trout. This will be an experienced to be enjoyed by all.

Raymond L. Filler Publicity Chairman

	PLENARY SESSION					
WED AM	GRAVITY	MICROWAVE OSCILLATORS				
	PROCESSING	MICROWAVE RESONATORS AND OSCILLATORS				
WED DM	RESONATOR EFFECTS AND PHASE NOISE	CHARACTERIZATION OF FREQUENCY SOURCES				
WED PM	ACCELERATION AND G SENSITIVITY	ATOMIC CLOCKS				
THUR AM	QUARTZ MATERIAL	TIME AND FREQUENCY MEASUREMENT				
	MATERIALS AND CONSTANTS	CRYSTAL OSCILLATORS				
	MEASUREMENTS AND STATISTICAL ANALYSIS	CRYSTAL OSCILLATORS				
THUR PM	CRYSTAL OSCILLATORS	TIME AND FREQUENCY TRANSFER				
	PIEZOELECTRIC RESONATORS AND FILTERS	ENVIRONMENTAL EFFECTS AND TESTING				
FKI AM	SAW DEVICES AND PHASE NOISE	TESTING AND MEASUREMENT				

UFFC-S 1989-90 Distinguished Lecturer Program

MICRO-SCALE MECHANICS FOR SENSORS AND ACTUATORS

Richard M. White, Fellow, IEEE 1989 Distinguished Lecturer

By using augmented integrated-circuit fabrication techniques, researchers around the world have recently made a wide variety of microsensors and microscopic moving elements. The goal is to realize inexpensive and small sensors and actuators for use in transportation, manufacturing and process control, health care, and consumer products.

Microsensors occupy the dimensional range from one micrometer, typical of film thicknesses, to a few millimeters, as shown in the Figure. To design these devices requires knowledge of micro-scale mechanical, thermal and electrical properties. For example, for vibrating membranes, beams and bridges we need elastic properties such as Young's modulus and Poisson's ratio of structures that are only about one micrometer thick; how are we to obtain such values? Worse, the films from which these structures are formed typically are grown or deposited on a solid silicon substrate, and then released by etching; what intrinsic stress develops during growth, and how can it be controlled? What are the thermal properties of such thin layers of semiconductors, insulators and conductors? And what about heat flow and friction between closely spaced microsensor or microactuator components?



COMPARATIVE SCALE OF MICROSENSORS

The microsensors and moving micromechanical elements are made by standard IC fabrication processes plus specialized steps such as orientation-dependent etching, depositing piezoelectric or pyroelectric films, growing low-stress layers of polycrystalline silicon or silicon nitride, and using sacrificial layers to make movable microscopic-sized parts. Among the miniature devices made by these processes are pressure sensors, accelerometers, gas flow sensors, a microphone on a chip, a versatile sensor employing ultrasonic waves propagating in micrometer-thick membranes, and microscopic gears, sliders, cranks and springs. Finally, electrostatically-driven micromotors narrower than a human hair have been demonstrated.

We need to know much more about material strength and fatigue, friction on a micro-scale, the effect of air damping and lubrication in small close-spaced structures, and even routine elastic and thermal properties of these thin-film substances. In addition to more conventional tools, the microstructures themselves are being used to obtain some of these properties. For example, a polycrystalline-silicon microbeam for a gasflow microsensor can be used to measure the thermal conductivity of that substance. The resonant frequencies of the microphone-on-a-chip's diaphragm provide information about the elastic properties of the membrane. The phase velocity of the ultrasonic waves in the membrane sensor gives a measure of the intrinsic stress of the membrane. Limiting speed and the rate at which moving micromechanical elements such as micromotors and spring-driven gears "slow down" provides information about friction and air damping. And fracture strength is being investigated with microscopic beamslider structures and springs deflected under observation until they break.

In this lecture we will describe some of these devices and their fabrication techniques. We will then consider the physical properties of these micro-scale elements and the measurement techniques used to obtain them.

Richard M. White (F '72) was born in Denver, Colorado and received his university education at Harvard. After completing the Ph.D. in applied physics in 1956, he participated in microwave component research at the General Electric Microwave Laboratory in Palo Alto, CA. In 1962 he joined the Department of Electrical Engineering and Computer Sciences, University of California, Berkeley, where he has been primarily concerned with teaching and research in solid-state electronics, with particular emphasis on ultrasonics and sensors.

His publications and inventions involve sensors, ultrasonic phenomena and devices, thermoelastic effects, and microwave electronics. Dr. White co-authored the text and reference book, Solar Cells: From Basics to Advanced Systems, McGraw-Hill, 1984. He was a Co-Guest Editor of the March, 1987 Special Issue on Acoustic Sensors, IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control (UFFC). In October 1988, he received the UFFC Society's Achievement Award for his contributions to the field of ultrasonics in photoaccustics, surface acoustic wave devices, and sensors. He is Co-Director of the Berkeley Sensor and Actuator Center, an NSF/Industry/University Cooperative Research Center.

Dr. White was a Guggenheim Fellow in 1968-9 and received the IEEE Cledo Brunetti Award in 1986. He is a Fellow of the IEEE, and a member of the American Physical Society, Sigma Xi and the American Association for the Advancement of Science.

Prof. White can be reached at the Department of Electrical Engineering and Computer Sciences, University of California, Berkeley, CA 94720. Phone: (415) 642-0540.





Awards

ACHIEVEMENT AWARD

Presented to:

Richard M. White Professor University of California Berkeley, CA

Citation:

"for launching innovative and fruitful ideas in Ultrasonics by making pivotal contributions to theory and experiment in photoacoustics, surface acoustic wave devices, and sensors."

- Presented at the 1988 Ultrasonics Symposium, in Chicago.
- Presentation to Dick White was made by Bob Adler (himself a recipient of this award in 1981.)
- The Achievement Award consists of a cash award, plaque, and a certificate.
- The Achievement Award recognizes an individual for outstanding contributions to, or technical achievements in, the field of Ultrasonics, Ferroelectrics, and Frequency Control.
- The Achievement Award is presented aperiodically. Since 1981, this award has been presented each year (total of nine recipients thus far).

OUTSTANDING CONTRIBUTION TO TRANSACTIONS AWARD

Presented to:

The guest editors of the <u>Special Issue on</u> Acoustic Sensors (March, 1987):

M. Edward Motamedi Asentec, Inc. Santa Maria, CA

Richard M. White University of California Berkeley, CA

- Presented at the 1988 Ultrasonics Symposium, Chicago.
- Selection of winner is based on:

Originality Interest to membership Contribution to field Clarity of writing Timeliness

- Although just two people (the guest editors) received the award, the award recognizes all 125 people who worked together to put this outstanding special issue together.
- The objective of giving an award every year is to encourage excellence in research and development, and recognize the extra work involved in writing a good technical paper. The Administrative Committee wishes to demonstrate to all authors that their efforts are appreciated.

FERROELECTRICS AWARDS

Presented to:

Dr. Kiyoshi Ohozaki National Defense Academy of Japan (for fracture mechanics in piezoelectric materials)

Dr. Jan Fousek Prague, Czechoslovakia (for studies in Ferroelectric domain walls)

- Plaques of Recognition were presented at the European Conference on Applications of Polar Dielectrics/IEEE International Symposium on Applications of Ferroelectrics held in Zurich, Switzerland, on September 1, 1988.
- Both recipients are retiring from their respective organizations this year.





Dick White receives Achievement Award from Bob Adler



Ed Motamedi and Dick White receive Transaction Award from Roger Tancrell

IEEE UFFC-S Members Elected to Fellow Grade

Congratulations to the following members of the Ultrasonics, Ferroelectrics and Frequency Control Society who were recently elected to the grade of IEEE Fellow.

IEEE MAILING ADDRESS

Professor Eric L. Adler Department of Electrical Engineering McGill University 3480 University Street Montréal, Québec, Canada H3A 2A7

Professor Charles A. Cain Department of Electrical and Computer Engineering University of Illinois at Urbana-Champaign Electrical Engineering Building Urbana, IL 61801

Dr. Eugene J. Dieulesaint 2, Avenue Francis Berthier 94100 Saint Maur, France

Dr. Alastair M. Glass AT&T Bell Laboratories Room 1A-155 Murray Hill, NJ 07974

Dr. Helmut W. Hellwig 13210 Colton Lane Darnestown, MD 20878

Dr. Reynold S. Kagiwada 3117 Malcolm Avenue Los Angeles, CA 90034

Mr. Bruce R. McAvoy
Westinghouse Research and Development Center
1310 Beulah Road
Pittsburgh, PA 15235

Professor William D. O'Brien, Jr. Department of Electrical and Computer Engineering University of Illinois at Urbana-Champaign Bioacoustics Research Laboratory 1406 West Green Street Urbana, IL 61801

Dr. Emmanuel P. Papadakis 1205 Ridgewood Avenue Ames, IA 50010

Dr. John R. Vig 33 Bucks Mill Road Colts Neck, NJ 07722

CITATION

For contributions to the analysis of acoustic surface-wave propagation and to electrical engineering undergraduate teaching.

For contributions to the understanding of biological effects of microwave and ultrasound radiation and for contributions to advancement of hyperthermia cancer therapy.

For contributions to acoustoelectronics and the application of surface acoustic-wave devices in signal processing.

For technical contributions and leadership in the engineering and development of electrooptic materials and devices.

For leadership in the development and application of atomic frequency standards in science, industry, and government.

For contributions to low-temperature ultrasonics and technical leadership in the development and insertion of microwave acoustic devices in space payloads.

For leadership in microwave acoustics with contributions to high-frequency resonators and signal processing devices.

For technical and administrative contributions to ultrasonic bioengineering.

For contributions to ultrasonic propagation in crystals and polycrystalline solids, development of ultrasonic measurement techniques for materials evaluation, and applications of electronics and physics for nondestructive testing.

For contributions to the technology of quartz crystals for precision frequency control and timing.

Membership Services

Membership services works with chapters, provides speaker services, our flag ship speaker is the Distinguished Lecturer and encourages other membership services through the various committees and activities. You should hear separately from both our chapters activities on a new chapter, our annual chapter stipend and our improving speaker support. Also you should hear separately about our membership development activities.

In this issue I want to discuss the need for developing membership in an organization like ours. Our major service to our membership is the Transactions and the conferences we sponsor. The Transactions is, of course, received by all our membership. It is also received by many libraries and by a significant number of individual subscribers. Though both of the latter do pay a significant premium to receive the Transactions, they make available the Transactions to a sizable number of nonmembers.

It is our function to provide the world's outstanding medium for publication of scientific and engineering literature in fields supported by ultrasonics and closely related technologies. To maintain our position as the world's foremost publisher of literature in our area, we need to maintain a high degree of loyalty from the community of contributors in our field. We feel our level and scope of membership interests is one very important barometer of our success in maintaining contributing community interest and loyalty for our publications and conferences.

Historically, the UFFC-S had grown gradually to a level of about 2300 members. For the past two years we have drifted downward to just about 2000. Though, it will be a few months before we can be sure, recent numbers would suggest that we are again on the verge of a gradual membership growth. We certainly hope this is true and that the services, Transactions, conferences and speakers, are bringing the quality of services that will engender membership loyalty and new member interest to indicate we are on the right track. We appreciate your comments.

> R.A. Moore Committee Chairman

Newsletter Editor's Note

The editor wishes to thank all those who submitted articles and photographs for this issue of the UFFC-S Newsletter. Also a special thank you to Kathy Nolan for typing the manuscript. Articles of interest to UFFC-S members are welcome. For inclusion in the Fall issue, please send by August 1, 1989, to Fred Hickernell, Motorola Inc., Government Electronics Group, 8201 E. McDowell Road, Scottsdale, Arizona 85252.

P.S. Jan Brown was our photographer for the candid snapshots pages 13-15.

New Chapter

We are happy to announce creation of a NEW UFFCS Chapter in Dallas/Fortworth. CONGRATULATIONS to Drs. Bob Potter and Carl Panasik for their successful efforts to create this chapter. UFFCS members/ potential members should take advantage of such a forum in their area.

New UFFCS Members Chapters

Several UFFCS members have expressed the feeling that they do not have any local UFFCS Chapters. I take this opportunity to invite all those UFFCS members who want a chapter in their region and can take leadership role to start a new chapter. Please contact me for guidance and assistance on "How to Start and Run A New Chapter".

Finance Assistance for Chapters

All chapters chairmen are reminded that financial assistance of \$250.00 is available every year for UFFCS Chapter Activities. This money can be used to enhance the chapter activities, paying for speakers who cannot afford travel, buying audio visual equipment etc. for your chapter. Application forms for this stipend can be obtained from:

> Dr. Narendra K. Batra Code 6385 Naval Research Laboratory Washington, D.C. 20375-5000 (202) 767-3505

It is recommended that you apply for this stipend as soon as possible. Deadline for 1988-89 is May I, 1989.

Chapters Officers Directory

All chapter chairmen are required to fill out "FORM-250" irrespective of whether or not they apply for financial assistance for their chapters. I request all chapter chairmen to contact me regarding this, as soon as possible. Thanks for your cooperation.

> Narendra K. Batra Co-Chairman, UFFCS Chapters Committee





Membership Report

As of February 1, 1989, the Ultrasonics, Ferroelectrics, and Frequency Control Society consisted of 2137 members. We wish to welcome the following new members who joined the society during the second half of 1988.

Ahmadzadeh, Mohammad R. Alaseer, Bassam R. Alessandro, Manneschi Alward, Theresa M. Anandan, N. Andreassen, Oyvind S. Ash, Darrell L. Ashraf-Zahoor, Rai-Mohd Bains, Raghbir S. Bakker, Robert B. Barrieskith, Nadine Barton, Andrew Basafa, Hossien Bates, Perry C. Berger, Mary E. Bilker, Scott L. Birx, Donald L. Bjornstrom, Gunnar A. Blair, Alistair T. Bleich, Charles R. Bosshard, Andreas M. Bruns, Robert W. Buehrer, Carl H. Cammarata, John P. Campagna, David P. Cha, Namnshik Chambers, John J. Chankil, Lee Chansoo, Chung Chao, Aungwin Cheul, Park J. Choi, Jae Ho Choi, Won-Taek Clark, Roger L. Columbus, Jo A. Conklin, Robert E. Corey, Lawrence G. Cowan, Judith A. Coyne, Bob M. Dantas, Lazaro Davin, Matthew J. DeGuzman, Belen D. Delvalle, Robert B. Demery, Ronald E. Dias, Carlos J. Dohmeki, Hideo Dolan Jr., M. Cristina Domino, William J. Doyle III, Joseph E. Eckersly, Gregory P. Ehsani, Mohammad S. Eltanany, Mohamed S. Engel, Rich Entrekin, Robert R. Esso, Michael N. Falconer, Robert S. Feng, Kai D. Ferrara, Katherine Fleischmann, Bernd Ford, James R.

Friedenberg, Howard Frysinger, William T. Fukumoto, Brian S. Furman, Eugene Galiano, Alberto C. Gargiulo, Joseph L. Gilbert, Stephan Gindre, Marcel Godfrey, R.B. Gray, James S. Gualtieri, John G. Habib, Maki K. Haider, Bruno H. Hanna-Hawver, Pamela D. Happ, Thomas A. Harvey, Dennis W. Hashemy, Naser Hatami, Hamid Hatjiagapis, Stefanos Herman, Robert W. Hines, J.H. Hirsch, Kelly L. Holgado, Mario Urea Horwitz, Adrian M. Hornsbostel, Earl H. Houshmand, Hooman Hu, Chenning Huang, Mark Po S. Huang, Rong F. Ibrahim, Edwar K. Ibrahim, Nabil M. Ibrahim, Tarek M. Inbar, Dan Ishida, Muneaki Israel, Henry M. Iwata, Wallace Jhunjhunwala, Ashok Johnston, Brian J. Johnston, Michael S. Jones, Roger P. Judy Michael W. Kang, Jae Wan Karbala, Hossain Kartaschoff, Peter Katz, Robert P. Kawate, Keith W. Kelly, Kenneth R. Kelly, Robert G. Khanna, Amarpal Kim, Daehoon Kim, Intaek Kimon, A. King, Michael B. Kjaer, V. Koide, Frank K. Kovacs, Guenter Krishnaswamy, S.V. Labridis, Dimitris Lachapelle, Denis D. Lampe, Donald R.

Larson, Daniel H. Lec, Ryszard M. Lee, Kang Ho Lee, Kang W. Lee, Yun Tae Ley, Antony J. Liou, Ia Lan N. Lotzer, Carey L. Lum, Paul Maleki, Lute Marttinen, Tapio Mash Jr., James T. McCullough, David J. McDonald, F.A. McDonald, Ryan O. McEathron, Brian Meldrum, M.A. Metchev PhD, Alexander N. Mew, Walton S. Miller, Steven C. Modarresi, S.M. Monteagudo, Peter P. Muat, Roger W. Murray, Stephen E. Mylvaganam, K. Saba Nadarajan, Porkodi N. Namvar, Hasaan Narayanadas, D. Narayanan, V.S. Nassar, Abubakr A. Needham, Howard M. Nepgen, Andre J. Newcomb, Ian Ng, Huat K. Ng, Y.S. Nitz, William A. Nomura, Tooru Olsson, Lennart B. Pan, Jeffrey Y. Park, Hyeong Bae Park, Sung K. Patil, Chetan D. Paxman, Wesley R. Penley, Stephen M. Pensante, Fred J. Price, Michael G. Quintal, Marc Ramsey Jr., G.L. Rao, Navalgund A. Reese, Steven E. Repetto, Steven G. Rice, Kent S. Richardson, Harold E. Rittenmyer, Kurt M. Robinson, Marshall T. Roh, Yongrae Rouquette, Robert E. Rudich, Irwin Ryu, Zee Man Sadeghipoor, Farhad

Sadighi, David C. Safar, Felix G. Salah, Mohamed W. Sanchez, Mariano M. Schidowka, George A. Schifferdecker, Todd W. Schock, Steven G. Schwarz, Hans-Peter Seiple, Steward L. Serbest, A. Hamit Shafiee, Hamid R. Sheldon, Douglas J. Shen, Qing Sherman, Kenneth N. Shih, Benjamin S. Shin, Dong-Sam Shimaka, Hiromitsu Shum, Daniel K. Sjoberg, Glenn Smith, Edward F. Smith, R.L. Song, Inchae Song, Joon T. Spanduru, Prakasarao Spurlock, Sandra E. Strozeski, Bernard B. Sum, K.K. Taalbi, Mustapha Tocca, Luigino Tsuchiya, Yutaka Tuladhar, Kanak K. Turner, Charles H. Uehara, Masahiro Usher, Paul C. Vaitilingame, Suresh Vanisri, Tongtod Varadi, George Vaughn, Clovis B. Visser, Clyde R. Vogelsang, Thomas L. Want, Tao Wang, Xiang Z. Warhola, Gregory T. Watkin, Kenneth L. Wiegert, Roy F. Witte, Robert S. Wong, Chon Meng Worms, Raymond Wright, Thomas A. Wu, Ching Chen Wu, Hsuan C. Yanchak, Andrew T. Yates, Douglas A. Yavuz, Huseyin Ylitalo, Juha T. Yoder, Enos D. Yuen, Chan C. Zayic, Jerry D. Zhengdi, Qin

Members are urged to help recruit persons interested in the Ultrasonics, Ferroelectrics, and Frequency control areas. UFFC membership materials may be obtained from:

Dr. Donald C. Malocha University of Central Florida Electrical Engineering Department Orlando, FL 32815-0450

Chapter Activities

Dallas - Fort Worth

A new section of the UFFC has been organized in the Dallas-Fortworth area. Bob Potter of RFM and Carl Panasik of Texas Instruments had decided a year ago to go ahead with the details of setting up the chapter which will consist of members from TI, RFM, University of Texas at Arlington, Hartmann Research, Southern Methodist University, University of Texas at Dallas, and a few other individual members.

This first year Bob will act as chairman and Carl as the Technical Program Chairman. A Secretary-Treasurer will be elected along with Bob and Carl at the first meeting which is scheduled for April, 1989.

This first year the chapter will have a monthly meeting with a special speaker to draw the group members and outside but interested IEEE members and others. A dinner before the meeting will be held in which our speaker will be honored and his dinner provided. The technical presentation will be held to about 1 hour and will adjourn about 9 pm. The first two meetings are set:

New	Officers	of	the	Orlando	Section	are:
	~U	· · ·	~	orrando	OCCLION	

Sam Richie, Chair EECS Dept., CEBA-I407 Univ. of Central Flordia Orlando, FL 32816 PH:407-281-5765

Sunder Gopani, Secr./Tres. SAWTEK, Inc. P.O. Box 18000 Orlando, FL 32860 PH:407-886-8860

Raymond Yap, V-Chair SAWTEK, Inc. P.O. Box 18000 Orlando, FL 32860 PH:407-886-8860

AWARDS

The Orlando Section UFFCS chapter is fortunate to have some outstanding engineers in its ranks. In 1986, Dr. William Horton was named as the Orlando Section Engineer of the Year. In 1987 he was nominated by the Orlando Section for Florida Council (FCIEEE) Engineer of the Year, which he won. He was subsequently endorsed by FCIEEE and the Orlando Section for Region-3 Engineer of the Year. Out of the 46 IEEE Region-3 sections, Dr. Bill Horton was chosen as the Region-3 Outstanding Engineer for 1988. Dr. Horton was cited for his work on the quartz crystal resonators, monolithic filters and quartz measurement techniques. He is currently president of Piezo Technology, Inc. (PTI), Orlando.

DATE:	THURSDAY 13TH APRIL
SPEAKER:	CLINTON S. HARTMANN
DINNER:	6:30 PM HIGHLAND PARK CAFETERIA
MEETING:	7:30 PM HARTMANN RESEARCH TO 5415 RIGEDALE 9:00 PM DALLAS, TEXAS 214-827-4940

TITLE OF PRESENTATION:

High Speed, Multi-Port RF network Analysis with greater than 10,000 Frequency samples and application to 5-Port SAW device measurement.

The second meeting is tentatively scheduled for May 11. The speaker will be Ken Goldstein of Clinitherm and he will speak about medical ultrasonics.

> Bob Potter Section Chairman

Orlando

The 1987 UFFCS Orlando chapter nominee for the Outstanding Engineer Award was Mr. Robert Smythe of PTI. From the seven Orlando Chapter's nominees, Bob was presented the 1987 Orlando Section Engineer of the Year Award in February 1988.

This year the UFFCS Orlando chapter has selected Mr. Sunder Gopani as the Chapter Outstanding Engineer. Mr. Gopani was recognized for his work on low loss surface acoustic wave technology, including integrated tuning and phasing, for SAWTEK, Inc. of Orlando.

MEETINGS

For 1989 the Orlando Chapter of the UFFCS has meetings scheduled or planned for several months consecutively. We are very excited about the guest speakers who have accepted invitations to speak to the chapter. The present schedule includes:

February 28th-Roy Brown, Research & Development, SAWTEK, Inc, will speak on SAW dispersive technology covering both design and applications.

March 30th-Dr. Joseph Heyman, NASA Research Center, will speak on nondestructive evaluation in aerospace. He will discuss requirements for science, sensors and sense. Dr. Heyman is a UFFCS Distinguished Lecturer.

April-Clinton Hartmann, Hartmann Research, Inc., will speak on SAW device applications and present technology. He is widely known for his innovation in SAW technology.

May-Dan Fliesh, Electronics Decisions Inc. (EDI), will discuss acoustic charge transport (ACT) device technology.

The Orlando Chapter of the UFFCS is off to a good start in 1989.

Sam M. Richie Chairman The Tokyo Chapter newly elected officers for 1989 are as follows:

- Chairman: Satoru Fujishima/Murata Manufacturing Co. Ltd., 2-26-10,Tenjin, Nagaokakyo-shi 617 Japan
- Vicechairman: Kenshiro Takagi/Institute of Industrial Science, University of Tokyo, 7-22-1, Roppongi, Minato-ku, Tokyo 106, Japan
- Secretary/ Toshihiro Kojima/Faculty of Engineer-Treasurer: ing, Tamagawa University, 6-1-1 Tamagawa-gakuen, Machida-shi 194, Japan

They have started their work immediately after the new years holiday synchronously with our new Emperor.

The Tokyo Chapter sponsored the USE 88 (the 9th Symposium on Ultrasonic Electronics), the biggest event of ultrasonics in Japan. It was held in Sendai on 7-9 Dec. 1988 and more than 90 papers including four invited lectures were given; 350 participants made intensive and extensive discussion on both fundamentals and applications of ultrasonics. The USE 89 will be held Dec. 12-14, 1989 in Tokyo.

Dr. Joe Heyman, the UFFC Distinguished Lecturer, was invited to Japan. He made a very impressive lecture on the up-to-date techniques of NDE at the USE 88. His paper will soon be published in "Ultrasonic Electronics" which is the supplement of Jpn.J.Appl.Phys. He was also asked to present a lecture at EIC Technical Group on Ultrasonics. After the very busy week as the Distingushed Lecturer, he and his nice family enjoyed an Asian Christmas Holiday.

The following eight technical meetings were held during the past half a year.

T.1. 07 1000	5	n	T - lass -
July 27,1900	2	rapers	τοκγο
Aug.26	6	Papers	Shizuoka
Sept. 19/20	17	Papers	Sendai
Oct. 13	5	Papers	Nagoya
Dec. l	10	Papers	Osaka
Dec. 13	6	Papers'	t Tokyo
Jan.25,1989	4	Papers	Tokyo
Feb. 22	5	Papers	Tokyo
*including Dr.	. He	eyman's	invited lecture

All the meetings had an audience of 30 to 70 persons.

Kenshiro Takagi Vice Chairman



At the banquet of the USE 88. From left, Professor Chubachi, Miss Laura Heyman, Dr. Heyman, Mrs. Berna Heyman and Professor Konno, the general chairman of the Symposium.



Dr. Heyman's lecture was entitled "NDE in Aerospace-Requirements for Science, Sensors and Sense" and the term "Sense" attracted a great interest from the audience.

IEEE 1989 ULTRASONICS SYMPOSIUM



October 3-6, 1989

Le Grand Hotel, Montréal, Québec, Canada Sponsored by The Ultrasonics, Ferroelectrics and Frequency Control Society

Important Transactions Information

Publication Backlog in the Transactions Eliminated

The <u>UFFC</u> Administrative Committee approved a 30% increase in the Transactions page budget for 1989. This increase was necessitated because of the backlog that was occurring in the time between when a paper was accepted to when it appeared in print. With the increased page budget, the backlog has been completely eliminated. Authors of papers can now expect that their contribution will appear in print within about 4 months from the date of acceptance.

William D. O'Brien, Jr. Editor-in-Chief UFFC Transactions

UFFC Letters

At the October 2, 1988, Administrative Committee meeting of the IEEE Ultrasonics, Ferroelectrics, and Frequency Control Society, a new and rapid form of communications was approved. The UFFC LETTERS are intended for rapid communication of new information and results on important topics of current interest in ultrasonics, ferroelectrics and frequency control. LETTERS submitted for publication should therefore present original work not previously published or under consideration for publication.

Timeliness is essential. Accepted LETTERS will be published within three months from time of submission to the appropriate Associate Editor. LETTERS will be reviewed in a binary fashion (accept, decline). The authors must be especially careful to ensure the accuracy of their submissions.

UFFC LETTERS contributions should not exceed two printed pages, including text, tables and figures. Instructions for authors of UFFC LETTERS can be found below.

The Editor would like to thank Professor Richard M. White who originally suggested the idea and provided the ground work to bring this service to you.

William D. O'Brien, Jr. Editor-in-Chief

INSTRUCTIONS FOR AUTHORS OF UFFC LETTERS

1) UFFC LETTERS is intended for rapid communication of new information and results on important topics of current interest in ultrasonics, ferroelectrics and frequency control. LETTERS submitted for publication should therefore present original work not previously published or under consideration elsewhere for publication.

2) Timeliness, current importance of the subject matter, brevity, and clarity of the presentation determine acceptability of contributions. Submissions lacking urgency may be recommended for publication as a FULL PAPER or CORRESPONDENCE in the TRANS-ACTIONS. 3) UFFC LETTERS should be submitted for publication to the appropriate Associate Editor, clearly identifying the contribution for the LETTERS.

4) Contributions of a theoretical nature should show clear application to the fields of the TRANSACTIONS. Authors of mathematical contributions should explain in detail the application of the mathematics. LETTERS should concentrate on results and conclusions, and include only as much supporting material as is required to understand the significance of the contribution properly.

5) LETTERS will be considered for review only once in a binary fashion (accept or decline). Authors are not encouraged to resubmit declined papers as LETTERS, and reviewers should bear this policy in mind as they evaluate manuscripts.

6) A LETTER accepted for publication and conforming to the manuscript requirements detailed below will normally be published within three months (from receipt of manuscript to appearance in print).

7) Decisions to publish contributions will be made on the technical merits of the manuscript, independent of the stated intention of the authors to pay voluntary page charges. Voluntary page charges of \$110 per printed page (maximum of \$220 per article) will be requested for all contributions to LETTERS. It is presumed that virtually all authors or their institutions will honor the voluntary page charges.

8) Manuscript requirements: Submitted LETTERS should conform to the general guidelines in the "Statement to Contributors" that appears in each TRANSACTIONS issue. The only exception to this is in regard to the manuscript length: published LETTERS must occupy not more that two journal pages, corresponding to not more than 1800 words of text, reduced by allowances for equations, tables, and figures. A typical figure with caption will displace about 250 words of text. Each LETTER should include an abstract of not more than 50 words. Biographies and personal photographs of the authors are not required and will not be published. A copyright form must be submitted with the manuscript to speed handling.

* * * * * * * * * *

Frequency Control Symposium Denver, May 31 - June 2

In the September 1988 issue of this Newsletter, I discussed the financial condition of our Society. In particular, I outlined why we got into financial difficulties in 1985 and 1986 and the steps that were taken to nurse us back to financial health. I am happy to report to you that even though we are not quite where we should be, our financial condition has improved substantially. Moreover, some of the steps taken in the recent past will not take effect until this year (notably the overlength page charges), further insuring the improvement of our financial condition.

Table I shows the 1988 UFFC Operating Statement (the data are pre-closing and pre-audit and thus subject to adjustments/corrections by IEEE). Note that we had a \$48.2K surplus, \$30.8K over the surplus budgeted, up from a surplus of \$21.7K in 1987 and deficits of \$0.5K, \$55.2K and \$11.3K in 1986,1985 and 1984, respectively. The two major items contributing to the increase in the surplus (also the two items that make up 90% of the overall budget) were the Transactions and the Symposia. The Transactions had a surplus of \$15.9K, primarily due to lower printing and editing cost by IEEE, while the Symposia showed a surplus of \$38.5K of which \$29.4K was contributed by the 1987 Ultrasonics Symposium and \$10.4K by the Frequency Control Symposium. We are especially happy to see the Frequency Control Symposium being able to return a surplus to the UFFC general fund; changing the venue from Philadelphia to different cities seemed to have increased interest in the Symposium since it did increase the attendance. Most of the other items that make up our budget came out as expected, with the exception of membership income. The reduction from \$33.3K to \$27.9K reflects a drop in membership. This may in part be due to two successive increases in membership dues in 1987 and 1988. Experience with IEEE membership has shown that an increase in dues causes an abrupt drop in membership.



Status symbol

Discover the single most vital source of technical information and professional support available to you throughout your working career... IEEE.

Join us.

However, after about two years the membership is back where it was before. More on membership is discussed in a separate article.

UFFC 1988 OPERATING STATEMENT

	Income		Expense		Net	
	Budget	Actual	Budget	Actual	Budget	Actual
Membership Fees	33.3	27.9	0.0	0.0	33.3	27.9
Interest	2.9	3.3	0.0	0.0	2.9	3.3
Transactions	174.8	170.8	180.5	154.9	- 5 . 7	15.9
Newsletter	0.0	0.0	6.0	5.6	-6.0	- 5.6
Non-Periodicals	3.5	3.4	5.1	4.3	-1.6	-0.9
Symposia	215.0	204.6	186.6	166.1	28.4	38.5
Administration	0.0	0.0	8.6	8.8	-8.6	- 8.8
Other	0.3	-0.3	25.6	21.8	-25.3	-22.1
Total	429.8	409.7	412.4	361.5	17.4	48.2

For this year the Transactions page budget has been increased from 800 pages to 1100 pages. This has already resulted in drastically reducing the backlog of papers. With the increase in the non-member subscription rate that goes with the larger number of pages and the effect of the overlength page charges we again expect a healthy surplus for the Transactions. Together with a continuing surplus from our Symposia, we expect to reach a reserve level that is commensurate with our level of expenses in about two years.

With the surplus of \$48.2K, the UFFC net worth as of 12/31/88 was \$131 K, It consisted of \$88.5K cash, \$30.0K outstanding loans and \$12.5K receivables.

H. Van de Vaart Chairman, UFFC-S Finance

Name	
Title	Phone ()
Pirm	
Address	
City	State/CountryPostal Code
▲ MA	IL TO: IEEE MEMBERSHIP DEVELOPMENT
-	
	The Institute of Electrical and Electronics Engineers. Ind

Scenes from the 1988 Ultrasonics Symposium



General Chairman: Bill O'Brien



Technical Chair: Jan Brown



President's Speaker: Simon Foner



AdCom Committee Meeting



Registration



Sunrise over Lake Michigan

Do You Know These AdCom Committee Members?



President: Gerry Farnell



Secretary - Treasurer: Harry Salvo



Transactions Editor: Bill O'Brien



Distinguished Lecturer Coordinator: Mack Breazeale



Standards Chair: Art (same tie as last year) Ballato



Acousto-Optics Standards: Dave "which way did they go" Hecht

Preparing for the 1989 Ultrasonics Symposium



Technical Chair: Gary Montress (L) and General Chair: Herman van de Vaart (R)



Group 3 Technical Vice Chair Art Ballato (standing) with Chief Photographer Jan Brown (center)



Group 4 Technical Vice-Chair Gary Montress (center) with Committee members.



Jim Greenleaf: Technical Vice-Chair of Group 1



Jerry Blessing: Technical Vice-Chair of Group 2

The Faces of Our Ultrasonic Symposium Technical Program Committee



Group 1 Medical Ultrasonics



Group 3 Physical Acoustics



Group 2 NDE and Sensors



Group 4 SAW



Group 2 NDE and Sensors



Group Dining

1989 ULTRASONICS SYMPOSIUM

This year's Ultrasonics Symposium will be held at Le Grand Hotel in Montreal, Que., Canada, October 4-6. It will be preceded by a day of short courses on Tuesday, Oct. 3. The organizing committee, shown on the "Call for Papers" printed elsewhere in this Newsletter, is hard at work trying to make it a success. What follows is a brief overview of the preliminary plans.

Technical Program

The technical program committee held its first meeting on February 13 where the overall framework for the program was set and the topics and speakers for the invited presentations were selected. The guidelines were the same as those for the most recent Symposia: a maximum of three days of no more than four parallel technical sessions, no invited presentations in parallel, and no oral sessions in parallel with the poster session(s). Within these guidelines, the committee selected a total of 29 speakers who will be invited to present invited talks. Four of these will be invited poster papers. The second program committee meeting is scheduled for June 28, 1989, at which time the contributed papers will be accepted or rejected, grouped into sessions and the complete program arranged. The result of all this effort is the Advanced Program Booklet which should be ready for mailing on August 15, 1989.

Short Courses

The short courses which were offered for the first time last year in conjunction with the 1988 Symposium were a tremendous success. A total of 219 people registered for the seven courses. Although we do not expect to repeat such a large attendance, a series of short courses again will be offered. Roger Colvin has put together a series of six courses. Because of their great popularity last year, two courses will be repeats: Bert Auld's course on "Fundamentals of Elastic Waves in Solids" and Richard White's course on "Acoustic Sensors". The other four are new for this year. A complete list of the courses and their starting times are listed elsewhere in this Newsletter.

Social Program

A cocktail party is planned for Wednesday evening in the hotel Ballroom. Every registrant will receive two free tickets for drinks. Food and hors d'oeuvres will be available. For those who prefer to have a formal dinner after the cocktail party, many excellent restaurants are within walking distance from the hotel.

A very special event is planned for the second night. We have reserved Le Festin du Gouverneur, a dinner-theater restaurant located in Montreal's historically renowned landmark, the Old Fort of Ile Ste-Helene. This will be

an unforgettable experience. You will wine and dine in the style enjoyed by the Gouverneur of New France and his noblemen in 1691. This is an historic and colorful adventure in delectable food and drink, and royal entertainment will be provided by the 17th century revelry of talented performers. The identity of the Gouverneur and his wife will be a surprise. Attendance is limited to 225 on a first come, first serve basis, so be sure to reserve your tickets with your advance registration

Spouse/Guest Program

The detailed spouse/guest program is still being worked on. Tours are planned for Wednesday, Thursday and Friday morning. On Wednesday morning, an opening visual talk on Native Canadian Art is being planned. The speaker owns her own art gallery in Montreal. Following the talk, there will be a tour of the city so that the spouses and guests will be able to get a good idea of the beauty of the city of Montreal. Highlights will include the Notre Dame Basilica, Golden Mile, Westmount residential district, St. Joseph's Oratory, Camilien Houde look-out on Mount Royal, Olympic Park, a ride on Funicular to the top of the tower for a breathtaking view of the city, Botanical Gardens and the Latin Quarter. For Thursday, preliminary plans include a trip to La Ferme St. Gabriel, lunch at Royal St. Lawrence Yacht Club and a visit to the Fur Trade Museum. For Friday morning, a walking tour of the Old Quarter is planned with stops at the George Etienne Cartier house, the Bonsecours Chapel, City Hall, Chateau Ramesay, Le Cours Le Royer and the interiors of the Notre Dame Basilica and the Bank of Montreal. As was done in San Fransisco in 1985, an allday trip is planned for the Saturday following the Symposium for all those who are interested. Two possibilities are being considered. One is a trip to Quebec City with visits to the National Assembly, Old City, the Citadelle, a ferry ride to view the city from the water, lunch at Chateau Champlain, on to Ste. Anne de Beaupre and Montmorency Falls. The other is a trip to the Laurentian Mountains with a boat ride on Lac des Sables and lunch at an exclusive resort. Remember that early October is the high point of the Foliage Season around Montreal and the colors will be spectacular. For either of these tours a minimum of 35 people is required; the cost will be around US\$40. The organizers of the spouse/guest program and the trip on Saturday are Norma Farnell, Helen Schwab and Tania van de Vaart.

Exhibits

Although the Ultrasonics Symposium draws only limited number of companies who are a exhibiting their products, both attendees and exhibitors have expressed interest in continuing the exhibits. If your company is interested in exhibiting, please contact LRW Associates at (301)-647-1591 or write to: LRW Associates, 1218 Balfour Drive, Arnold, MD 21012. LRW will also assist in the paperwork required for shipping the exhibit to Canada.

Ultrasonics Symposium

Registration

The registration fees for this year have been set as follows: IEEE members: Advance \$175, on-site \$205; Non-members: Advance \$235, onsite \$265 and Students: Advance \$25, on-site \$40. A registration fee of \$20 will be required for spouses and/or guests to defray the cost of providing a continental breakfast every morning. The fees quoted above are US dollars. All advance registrations should be made in US dollars. On site the registration fees can be paid in US dollars or in Canadian dollars at the then prevailing exchange rate.

<u>Conference Hotel</u> Le Grand Hotel is situated in the heart of downtown Montreal. It is the only hotel within the historic boundaries of Old Montreal and is in the same complex as the stock exchange and across the street from the Place Bonaventure trade center. It has direct access to the metro. It boasts seven restaurants and bars, one of which is the Tour de Vile, Montreal's only revolving rooftop restaurant. It also features a heated pool, sauna and a nautilus equipped gym. Dorval Airport is 25 minutes away, Mirabel International Airport 45 minutes. More information on transportation from the airports to the hotel will be provided in the advance program.

The organizing committee hopes you will come to Montreal for the 1989 Ultrasonics Symposium in October. It promises to be an exciting Detailed information on all events event. during the Symposium will be given in the advance program.

H. Van de Vaart Conference Chairman 1989 Ultrasonics Symposium

AdCom Briefs

The Fall '88 Administrative Committee (ADCOM) Meeting of the Ultrasonics, Ferroelectrics and Frequency Control Society (UFFC-S) was held October 2 1988 prior to the 1988 Ultrasonics Symposium in Chicago, Illinois. At this meeting President G. W. Farnell announced the appointment of H. L. Salvo, Jr. as Secretary/Treasurer of the UFFC-S ADCOM. President Farnell also introduced the new elected members of the ADCOM whose terms begin in 1989: Celia E. Yeack-Scranton, James C. Greenleaf, Donald C. Malocha and Helmut Ermert.

It was reported that UFFC-S has agreed to sponsor the Acoustical Imaging Conference. Also IEEE is setting up a superconductivity committee in part to resolve the problem of the Applied Superconductivity Conference which is held in conflict with other IEEE conferences. The IEEE has asked each Society if they were interested in participating. We have indicated that we would like to participate.

Briefs

H. Van de Vaart presented the UFFC-S budget. He reported that voluntary pages charges, budgeted at 35%, is actually running at 50 -55%. The projected surplus for 1989 is approximately \$51K. He pointed out he is projected a \$20K surplus for the Transactions and a \$40K surplus from the meeting.

H. Van de Vaart next reported on the current financial condition. The membership income is effectively all in and below budget which the reflects decrease in membership. Periodicals are running close to budget in income but expenses are down. No meeting income has been credited to our account as yet. The \$16K is a partial return from the Proceedings Book Broker Plan. As of August 1988, we have a net income of \$61K which should hold to the end of the year. The net worth of the UFFC-S as of August 31, 1988 is \$128.1K. This consists of \$85.4K of cash, \$20.0K of outstanding loans, and \$22.7K of accounts receivable.

O'Brien gave the report on the ions. He reports that the 1988 D. Transactions. September issue has been mailed. The November issue is a landmark issue in that it is the transitional issue having the first papers to fall under the mandatory page charges (11 papers in this are subject to over-length page charges). All papers from this point are now subject to the over-length page charge.

The 1989 issue has a page budget of 1100 pages. The January and March issues are already at IEEE Publication Services. They have 19 and W. D. O'Brien 21 papers, respectively. announced the appointment of Don Malocha as the Associate Editor of Systems Applications.

R. A. Moore announced that Don Malocha is the new Membership Subcommittee Chairman, replacing H. L. Salvo, who has resigned to become UFFC-S ADCOM Secretary. He mentioned that our peak membership was 2352 in 1985 and has been slowly down to a current level of drifting approximately 2000 at the end of 1987.

H. L. Salvo presented the membership report. As of July, our membership was 1944 which is a decrease of 74 members from the same period in 1987.

N. Batra reported on the interest in starting chapters in Boulder, CO; 2 in China; Dallas, TX and Los Angeles, Ca.

M. Breazeale report that a list of potential Distinguished Lecturers is being put together and he is soliciting the name of possible candidates from members of ADCOM.

R. H. Tancrell gave the report on the Awards. He reported that the plaques honoring the past presidents will be presented at the Ultrasonics Symposium. These will be presented to W. D. O'Brien, H. Van de Vaart, and B. R. McAvoy. In the future, such a plaque will be presented to the retiring president at the Ultrasonics Symposium.

AdCom

He reported that the Outstanding Contribution to Transactions is being awarded to the guest editors of the special issue on acoustic sensors: M. Edward Motamedi and Richard M. White.

The Achievement award is being presented to Richard M. White. The award will be presented at the Ultrasonics Symposium by Robert Adler.

The Frequency Control awards were presented as follows: The Cady Award presented to Baldwin Sawyer and the Rabi Award presented to Gernot M. R. Winkler.

Ferroelectrics presented plaques of recognition to Kiyoshi Ohozaki and Jan Fousek at the 1988 ISAF.

G. W. Farnell announced that R. S. Kagiwada and K. Yen have asked to be relieved of the General Co-Chairman and Technical Chairman, respectively, of the 1990 Hawaii meeting. He has asked M. Levy to take over the General CoChair and H. L. Salvo to handle the Technical Chair and they have accepted.

D. Malocha reported that G. W. Montress will be the Technical Chairman of the 1991 Ultrasonics Symposium to be held in Orlando, FL.

G. W. Farnell announced that F. S. Hickernell has agreed to be the General Chairman of the 1992 Ultrasonics Symposium. The ADCOM selected Tucson, AZ as the meeting site.

T. E. Parker reported on the 42nd Annual Frequency Control Symposium. The attendance was up to 9% to 367. The 1989 Frequency Control Symposium will be in Denver, CO. The ADCOM approved the 1990 Frequency Control Symposium to be held in Baltimore, MD.

T. E. Parker presented a preliminary budget for the 1990 Frequency Control Symposium. The registration fee has been increased \$5.00 except for students. The budgeted surplus is about \$7.5K.

The ferroelectrics report was given by W. Smith. The 1988 ISAF was held in Zurich. The conference attendance was 281. W. Smith reported that the next meeting will be at the University of Illinois in June 1990. The 1992 meeting will be held in 1992 but no discussions have been held as yet. G. W. Farnell reported that R. White has taken over the Fellows Committee from G. Kino. G. W. Farnell announced that B. Tittman has agreed to take over the Nomination Committee from J. D. Larson.

ADCOM acknowledged the work that J. D. Larson did chairing the Nominations Committee with a vote of thanks.

ADCOM elected the following officers for 1989: 6. in. Farnell, President and J. Brown as Vice-President.

> Harry L. Salvo, Jr. Secretary - Treasurer

Distinguished Lecturer and Speakers' Bureau Activities

past several years the For the Distinguished Lecturers have provided a valuable service to the UFFC Society by lecturing to almost all of the local chapters in the USA and abroad and have lectured to many university student groups as well. The Distinguished Lecturer is selected annually. He is a scientist of outstanding qualification who has achieved distinction because of his research in a scientific field of interest to the Society. Past lecturers have covered a wide variety of topics, often at a time the topic is emerging as a field specialization. Such activities, carried out over a period of time, have covered almost the complete range of interest of the UFFC Society. Through its representative, the ADCOM annually asks members of the parent organization and chapter members suggest speakers and topics for to Distinguished Lectures.

Notification of Society members of the new Distinguished Lecturer is made in the Society Newsletter. An abstract and vita is included at the time of the original announcement, as currently is the case with Dr. Richard M. White. Chapter members and Chairmen are encouraged to contact the Distinguished Lecturer directly to arrange a time for him to visit. A stipend is provided by UFFC to help defray the expenses of the Distinguished Lecturer.

To provide additional speaker support ADCOM has asked for and received a list of volunteers who are prepared to travel a few hundred miles from their home laboratory to speak at local Chapter meetings. The Speakers' Bureau currently comprises a list of 32 speakers with lecture topics they are prepared to speak on. Volunteers for the Speakers' Bureau can contact Leland Solie[(212) 367-2600], who compiles the Speakers' Bureau list and provides a copy to local chapters. Chapter officers are encouraged to contact speakers from the Speakers' Bureau to arrange a visit of their choice. Some of the speakers can travel at their employer's expense. If not, one resource is an annual stipend provided by the Society of up to \$250/chapter for qualifying chapter program activities. Chapters with qualifying activities should apply through Narendra Batra [(202) 767-3505].

In my role as Chairman of the Distinguished Lecturer Subcommittee, I am interested in encouraging effective use of the speaker resources: the Distinguished Lecturer and the Speakers' Bureau. Of course, Chapter Chairmen are encouraged independently to contact speakers and arrange lectures to the Chapters. In addition, over the next few months I will attempt to contact Chapter Chairmen in an effort to evaluate and satisfy the needs of local Chapters for outstanding speakers.

> M.A. Breazeale Distinguished Lecturer Coordinator (601) 232-5889

Standards Activities Report

Our society is currently responsible for ten items, four standards and six projects.

Piezoelectric Crystals - T.R. Meeker (176-1987)

This subcommitte will meet in Dallas in February to decide on future work, particularly on the status of Standard 177.

<u>Ultrasonics in Medicine</u> - F.W. Kremkau (P790)

The draft standard was approved by Rev Com with title changed to "Medical Ultrasound Field Parameter Measurement Guide." It was forwarded to the IEEE Editorial Office at year's end, but it now appears that the office has misplaced the illustrations.

Time and Frequency - J.R. Vig (P1139 and P1193)

Pl139 "Standard Definitions of Physical Quantities for Fundamental Frequency and Time Metrology" was approved by the IEEE Standards Board and forwarded to the Publications Office for editing and issuance as an IEEE Standard.

PAR 1193 "Standard Test Methods for Environmental Sensitivities of Standard Frequency Generators," was approved by the IEEE Standards Board as a working project. It will be the subject of a special session at the 43rd Annual Frequency Control Symposium.

Sensors - J. Schoenwald (P1182)

The poster paper at last year's Ultrasonics Symposium was used to collect inputs for an article on terms and definitions of sensors to be submitted to Trans UFFC. The PAR P1182 "Ultrasonics, Ferroelectrics, & Frequency Control Based Sensors" is being updated for resubmission to the IEEE Standards Office.

Surface Acoustic Wave Devices - E.A. Mariani (P1037)

The draft standard will be sent to the IEEE Standards Office for editing.

Piezomagnetic Technology - S.L. Ehrlich (319-1971)

The revision of Standard 319 (Magnetostrictive Material: Piezomagnetic Nomenclature) is being worked on; the subcommittee is formed, and the PAR will be sent to the IEEE Standards Office by the end of February.

Industrial Ultrasonics - E.P. Papadakis

Presently inactive

Ferroelectrics - A.H. Meitzler (180-1986)

Thin ferroelectric memory films, pyroelectricity, and electrostriction are areas under consideration for standardization.

Acousto-Optics - D.L. Hecht (P1022)

A draft nomenclature standard is in preparation.

Delay Lines - A.A. Comparini

Presently Inactive.

Arthur Ballato Chairman, Standards Activities

Future Symposia

1989 IEEE Ultrasonics Symposium October 4-6, 1989 Montreal, PQ Canada

For Information:

H. van de Vaart, General Chair Allied Signal Incorporated P.O. Box 1021 R Morristown, NJ 07960 201/455-2482

1990 IEEE Ultrasonics Symposium Date: December 5-7, 1990 Honolulu, Hawaii

For Information:

Moises Levy, General Co-Chair Dept. of Physics Univ. of Wisconsin-Milwaukee Milwaukee, WI 53211 (414) 229-4168

N. Mikoshiba, General Co-Chair Research Institute Electrical Communications Tohoku University Katahira Sendai 980, Japan (0222) 27-6200

1991 IEEE Ultrasonics Symposium December, 1991 Orlando, FL.

For Information:

D. C. Malocha, General Chair Department of Electrical Engineering University of Central Florida Orlando, FL 32816 305/275-2414

Also, periodically a list of meetings sponsored by the IEEE Ultrasonics, Ferroelectrics and Frequency Control Society is published in the <u>IEEE Transactions</u> on Ultrasonics, Ferroelectrics and Frequency Control.

ISWASS '89

The Second International Symposium on Surface Waves in Solids and Layered Structures (ISWASS) will be held in Varna, Bulgaria, the 14th to the 19th of September 1989. Information on this conference, which is being held concurrently with the International Scientific Technical Conference on Acoustoelectronics "Acoustoelectronics '89", can be obtained by writing:

Dr. Ivan Avramov Institute of Solid State Physics Bulgarian Academy of Sciences 72, Lenin Boul. 1784 Sofia, Bulgaria



IEEE 1989 ULTRASONICS SYMPOSIUM



October 3-6, 1989

Le Grand Hotel, Montréal, Québec, Canada

Sponsored by The Ultrasonics, Ferroelectrics and Frequency Control Society

GENERAL CHAIRMAN

Herman van de Vaart Allied-Signal Inc. P.O. Box 1021 R Morristown, NJ 07960 (201) 455-2482

TECHNICAL PROGRAM

Gary K. Montress Raytheon Company Research Division 131 Spring Street Lexington, MA 02173 (617) 860-3053

FINANCE

Janpu Hou Allied-Signal Inc. P.O. Box 1021 R Morristown, NJ 07960 (201) 455-3439

PUBLICATIONS AND PUBLICITY

Narendra K. Batra Naval Research Laboratory Code 6385 Washington, D.C. 20375 (202) 767-3505

LOCAL ARRANGEMENTS

Jean Bussiere National Research Council Canada Industrial Materials Research Institute 75, De Mortagne Boucherville, Que., Canada J4B 6Y4 (514) 641-2280

SHORT COURSES

Roger D. Colvin 10917 Little Sparrow Place Columbia, MD 21044 (301) 740-0227

PROCEEDINGS EDITOR

Bruce R. McAvoy Westinghouse R&D Center 1310 Beulah Road Pittsburgh, PA 18103 (412) 256-1470

CONFERENCE MANAGEMENT

LRW Associates 1218 Balfour Drive Arnold, MD 21012 (301) 647-1591

Call For Papers Deadline: Wednesday, May 31, 1989

Papers are solicited describing original work in the field of Ultrasonics. Papers concerned with mechanical wave phenomena, including the Subject Classifications below, will be considered.

ABS	Arrays and Beam Steering	NS
ACE	Acousto-Electric Effect and Devices	PA
AE	Acoustic Emission	PA
AM	Acoustic Microscopy	PF
AO	Acousto-Optic Effects and Devices	PM
AOS	Acousto-Optic Signal Processing	SE
BB	Bioeffects and Biophysics	SE
BW	Bulk Wave Effects and Devices	SF
DMC	Defect and Material Characterization	SM
ED	Exposimetry/Dosimetry	SP
FM	Flow Measurement	SR
GA	Geophysical Acoustics	SS
HT	Hyperthermia	SS
HTS	High Temperature Superconductors	TC
IS	Inverse Scattering	TFI
IU	Industrial Ultrasonics	TF
M	Medical Imaging	TH
MSP	Medical Ultrasound Signal Processing	TM
MSW	Magnetostatic Waves and Devices	US
NDE	Nondestructive Evaluation	

NSP PA	NDE Signal Processing Physical Acoustics
PAS	Photoacoustics
PF	Piezoelectric & Ferroelectric Materials
PMC	Process Monitoring and Control
SEN	Sensors
SEP	Sonically Enhanced Processing
SFT	SAW Filters and Transducers
SMP	SAW Materials and Propagation
SP	Speckle
SRO	SAW Resonators and Oscillators
SSA	SAW System Applications
SSP	SAW Signal Processing
тс	Tissue Characterization
TFB	Thin Films (Bulk & Optical Devices)
TFS	Thin Films (Surface Wave Devices)
тн	Therapeutics
TM	Tomography

S Underwater Sound

Authors of contributed and invited papers are required to submit an abstract. Carefully follow the PREPARATION OF ABSTRACTS instructions on page 2 and send to:

Dr. Gary K. Montress c/o LRW Associates 1218 Balfour Dr. Arnold, MD 21012

The abstract original (unfolded) and 2 copies should be provided. Deadline for receipt of abstracts is Wednesday, May 31, 1989.

Each abstract will receive careful evaluation. A good abstract clearly explains the paper's intent and content. Evaluation criteria will include: CONTRIBUTION TO THE STATE OF THE ART, ORIGINALITY OF THE WORK, AND OVERALL INTEREST TO THE ULTRASONICS COMMUNITY.

POSTER SESSIONS will provide an alternative format which allows greater flexibility for the presentation of new work.

STUDENT TRAVEL SUPPORT—Some limited travel assistance is available to support student attendance at the Symposium. Awards will be made on a competitive basis. Further information and applications can be obtained from: G. W. Farnell, Dept. of Electrical Engineering, McGill University, McConnell Engineering Bldg., 3480 University, Montreal, Quebec H3A 2A7, Canada. The deadline for applications will be June 30, 1989.



PREPARATION OF ABSTRACTS



1989 IEEE ULTRASONICS SYMPOSIUM 1218 BALFOUR DRIVE ARNOLD, MD 21012 USA



CALL FOR PAPERS



IEEE 1989 ULTRASONICS SYMPOSIUM



October 3–6, 1989

Le Grand Hotel, Montréal, Québec, Canada

Sponsored by The Ultrasonics, Ferroelectrics & Frequency Control Society

GENERAL CHAIRMAN Herman van de Vaart Allied - Signal Inc. P.O. Box 1021 R Morristown, NJ 07960 (201)-455-2482

TECHNICAL PROGRAM Gary K. Montress Raytheon Company

Research Division 131 Spring Street Lexington, MA 02173 (617)-860-3053

FINANCE

Janpu Hou Allied-Signal Inc. P.O. Box 1021 R Morristown, NJ 07960 (201)-455-3439

PUBLICATIONS AND PUBLICITY

Narendra K. Batra Naval Research Laboratory Code 6385 Washington, D.C. 20375 (202)-767-3505

LOCAL ARRANGEMENTS

Jean Bussiere National Research Council Canada Industrial Materials Research Institute 75, De Mortagne Boucherville, Que., Canada J4B 6Y4 (514)-641-2280

SHORT COURSES Roger D. Colvin 10917 Little Sparrow Place Columbia, MD 21044 (301)-688-6255

PROCEEDINGS EDITOR

Bruce R. McAvoy Westinghouse R&D Center 1310 Beulah Road Pittsburgh, PA 18103 (412)-256-1470

CONFERENCE MANAGEMENT LRW Associates 1218 Ballour Drive Arnold, MD 21012 (301)-647-1591

Short Courses

Tuesday, October 3, 1989 Le Grand Hotel Montreal, Quebec, Canada

Six continuing education short courses will be offered the day preceding the Symposium. The fee for *each* course is \$110 for IEEE member (\$140 for non-member and \$50 for students.)There is a \$10 discount if the registration fee is paid before September 15, 1989. A set of course notes will be provided with each course.

The IEEE 1989 Ultrasonic Symposium Advance Program (available August, 1989) will include the registration form for the short courses. Registration for the short courses is on a first come, first serve basis. Registration will be accepted with the fee up to the time of the short courses. However, attendance for each course is limited and the courses may be closed prior to October 3. We reserve the right to cancel any course due to insufficient preregistration.

Fundamentals of Elastic Waves in Crystals

Instructor: Bert A. Auld, Department of Applied Physics, Stanford University

Course 1 Tuesday 3, October 8:00 am - 12:00 noon

This introductory/intermediate level tutorial will provide a coherent development of elastic waves In solids. Anisotropy has long been a physical property of importance to physicists and engineers concerned with elastic waves in crystals, for both fundamental research and device development. Very recently it has also become a significant issue for NDE engineers working with textured materials and composites, and to geophysicists concerned with anisotropy in rocks. The course is directed primarily to practicing engineers and researchers with some knowledge of isotropic elasticity, who are beginning (or intend) to work with anisotropic materials. Matrix notation, rather than tensor notation will be used throughout. Topics include basic concepts of elasticity, anisotropic bulk wave equations with and without plezoelectricity, crystal classes and orientation, beam steering and diffraction. Surface and leaky waves will also be considered briefly.

Bert A. Auld, received his Ph.D. in electrical engineering from Stanford University, where he is currently Professor (Research) in Applied Physics. In 1973 he became a Fellow of the IEEE and in 1983 received the IEEE Ultrasonics Achievement Award for theoretical contributions to ultrasonics. He is the author of a two-volume text Acoustic Fields and Waves in Solids, published in 1973 by Wiley-Interscience. Acoustic Sensors Instructor: Richard M. White, University of California, Berkeley

Course 2 Tuesday 3, October 1:00 pm-5:00 pm

This course will survey acoustic techniques for sensing more than twenty measurands, which can be grouped under the headings acoustic, biological, chemical, electric, magnetic, mechanical, and thermal. Physical principles will be emphasized, and typical sensor performance will be given. Principles to be discussed are: measprement of the characteristics of transmitted or reflected bulk or surface waves (for example, in non-destructive materials evaluation, medical imaging, surface characterization, and position sensing); study of sound emitted from structures under stress (for example, to assess structural integrity); and shift of frequency of resonators or (for example, to sense delay-line oscillators biological substances, vapors, electric and magnetic fields, pressure, acceleration, and temperature). Characteristics of different types of propagating waves will be discussed, together with contacting and non-contacting transducers. An undergraduate degree in electrical engineering or physics is suggested for attendees.

Richard M. White received the Ph.D. degree in applied physics from Harvard University. After working six years on microwave devices at the General Electric Microwave Laboratory, he joined the University of California at Berkeley, where he is now a Professor. His publications and patented inventions concern sensors, ultrasonic phenomena and devices, and thermoelastic ef-



phenomena and devices, and thermoelastic effects, as well as stroboscopic scanning-electron microscopy and microwave electronics. White co-authored the text and reference book, "Solar Cells: From Basics to Advanced Systems", Mc Graw-Hill, 1984. He is a director of the Berkeley Integrated Sensor Center, an NSF/Industry/University Cooperative Research Center, and was a Guest Editor of the March 1987, Special issue on Acoustic Sensors of the *IEEE Trans. UFFC*. An IEEE Fellow, White received a Guggenheim fellowship in 1968-9, and the IEEE Cledo Brunetti award in 1986.

Optical Detection of Ultrasound

instructor: Jean - Pierre Monchalin, National Research Council of Canada

Course 3

Tuesday 3, October 1:00 pm - 5:00 pm

Optical techniques for the detection of ultrasound have several distinct advantages over the classical plezoelectric detection methods. Their remote sensing and noncontact nature offers the possibility of measurements in harsh environments such as elevated temperatures, and of measurements on samples of complex shapes. They also feature a broad bandwidth of detection over areas ranging from point-like to about one inch and more. They are often easily calibrated and permit absolute measurements of ultrasonic motion. Although most of the techniques are used to detect the out-of-plane motion, it is possible in some cases to measure in-plane displacements as well. Therefore, these techniques could have applications ranging from simple transducer calibration to sophisticated remote ultrasonic sensors for industrial processes and should be of interest to a broad range of practitioners of ultrasound and researchers in the field.

This course will follow the approach taken in the paper "Optical Detection of Ultrasound" (IEEE Trans. on Ultrasonics, Ferroelectrics and Frequency Control, UFFC-33, September 1986) by reviewing non-interferometric techniques (e.g. knife-edge) and interferometric techniques (optical heterodyning, differential interferometry, velocity interferometry). Developments which have occurred in this area since the beginning of 1986 will be presented as well.

Jean-Pierre Monchelin received a diploma in optical engineering in Paris in 1968 and the M.S. and Ph.D. degrees in lasers and optics from the Massachusetts institute of Technology, Cambridge, in 1971 and 1976, following doctoral work on a very accurate interferometric measurement in the infrared which led to a new value for the speed of light.

He is presently senior research officer at the Industrial Materials Research institute of the National Research Council of Canada in Boucherville, Quebec. He was previously employed by l'Ecole Polytechnique in Montreal and worked on chemical laser development, photoacoustic techniques and, in particular, on their application to the spectroscopy of powders. He has been involved with ultrasonic nondestructive evaluation since 1982. He is presently leading development work in laser and optical techniques to generate and detect ultrasound for Industrial applications. He is holder of several patients in this field. He was granted the Best Paper Award by the Ultrasonics, Ferroelectrics and Frequency Control Society of the IEEE in 1986 for his review paper entitled "Optical Detection of Ultrasourd".

Sensor Technology for Robotics

Instructor: Jeff S. Schoenwald, Rockwell Internetional Science Center Course 4 Tueeday, 3 October 6:00 pm - 10:00 pm

This course will survey techniques for sensing required for control of industrial and research robots. We will begin with a short review of the basic architectures of robotic systems, from simple pick and piace machines to sophisticated coordinated multiple manipulator workcells with a varied array of sensors, linked together by a hierarchy of controllers and computers, all supervised by software. Focussing on the sensors we will take a look at computer vision, optical range sensing and scanning, acoustic ranging and imaging, thermal, tactile, force and torque sensors. In particular, we will examine the scope and range of electrical, magnetic, mechanical and optical technologies that have been brought to bear on the problem of machine sensing. Modern developments seem to be pushing in the direction of solid state micromachined silicon sensors. Several of these

which are specific to robotic sensing will be described. Jettrey 8. Schoenweld is Manager of the Sensor Technology Department, Rockwell international Science Center. He obtained his B.S. in Physics at the Massachusetts institute of Technology in 1967 and a Ph.D., also in Physics, from the University of Pennsylvania in 1973. He has over 15 years experience in solid state physics, optics, device research, sensing systems and automation research and technology. His areas of technical interact over the years have included guided optical, surface acoustic (SAW) and interfacial electromagnetic waves (surface polaritions),ultrasonics, nondestructive evaluation (NDE), hydrophones, accelerometers, pressure, strain and tactle sensing, frequency control for navigation, communications and sensing, laser / fiber optic interconnect, robotic end effectors, solid state actuators and control systems. Schoenwald is a past elected member of the Administrative Committee of the IEEE Society for Ultrasonics, Ferroelectrics and Frequency Control (UFFC) and an editor of the Society's journal, an editor of the IEEE Journal of Robotics and Automation, and a member of the Advisory Board of the British Journal Ultrasonics. He holds two patents and is the author /co-author of more than 55 publications, journal articles, and an article on robotic sensors in the Encyclopedia of Science and Technology.

Acoustic Microscopy

Instructor: B.T. Khurl - Yskub, Ginzton Laboratory, Stanford University Course 5

Tuesday 3, October 6:00 pm - 10:00 pm

This intermediate level course will cover the principals of acoustic microscopy. First, a tutorial of the principal of operation of the acoustic microscope and its contrast mechanism will be presented. Next, we will cover the design and implementation aspects of transducers, buffer rods, and lenses, and their dependence on the material under test. The contrast mechanism of the microscope will be described. Several implementations of acoustic microscopes will be shown, and, lastly, we will present examples of various applications and quantitative measurements using acoustic microscopes. Prerequisites: Course 1, or equivalent.

Butrue T. Khuri-Yakub was born in Beirut, Lebanon. He received the B.S. degree in 1970 from the American University of Beirut, the M.S. degree in 1972 from Dartmouth College, and the Ph.D. degree in 1975 from Stanford University, all in electrical engineering.

He joined the research staff at the E.L. Ginzton Laboratory of Stanford University in 1976 as a research associate. He was promoted to a Senior Research Associate in 1978, and to a Professor of Electrical Engineering (Research) in 1982. His current research interests include thin film deposition, GaAs processing, electro-optic devices, bulk wave transducers and arrays, the nondestructive evaluation of structural materials, acoustic imaging, microscopy, photo-acoustic interactions, and lately ultrasonic measurements of the marine microlayer. Professor Khuri-Yakub is a senior member of the IEEE and the Acoustical Society of America.

Professor Khuri-Yakub has authored 175 publications and has been principal inventor or co-inventor on twenty-four patents.

Thin-Films For Saw Applications

instructor : Fred S. Hickernell, Motorola inc. Course 6 Tuesday 3, October 6:00 pm - 10:00 pm

Thin-Films play a key role in SAW technology. Metallic films are essential for the generation and detection of surface acoustic waves and can provide directional control for wave propagation. A variety of dielectric films have been extensively used to selectively attenuate and modify the velocity property of surface waves. Semiconductor films on plezoelectric SAW substrates permit the development of a variety of active acoustoelectronic devices. Plezoelectric films extend SAW device development to amorphous and nonplezoelectric semiconductors for enhanced performance, lower cost and microelectronic integrability. This course will describe the theory and practice of using thin-films to enhance SAW device development in the aforementioned areas. Techniques for film fabrication will be addressed and the effects of process and film structure on the surface acoustic wave properties will be delineated. Techniques for the determination of the elastic, plezoelectric and loss properties of films will be presented. A basic knowledge of thin film properties and deposition methods together with an understanding of Rayleigh wave propagation will be helpful in getting the most from this course.

Fred S. Hickerneli received the B.A. in Ed. and M.S. and Ph.D. degrees in physics from Arizona State University. He is presently a Member of the Technical Staff with Motorola's Government Electronics Group in Scottsdale, Arizona. Before joining Motorola inc. In 1960, he served as a weather officer in the USAF and as an engineer in the theoretical group of Goodyear Aerospace. His work over the past 20 years has involved the Investigation and application of dielectric and piezoelectric films to accustical and optical microelectronic devices. He has published over 70 scientific and engineering papers.

Distinguished Lecturer Report

I am happy to report that the IEEE-UFFC Lecture program has been going very well this year with about 1000 people in attendance at the 11 presentations held to date. The following is my current schedule with some opportunities for additions. Items with \bullet are joint with IEEE.

<u>Date</u>	Location	<u># People</u>	Point of Contact
10/18/88	Marquette Univ.	200	Prof. Susan Schneider
11/8/88	Univ. Rochester	60	Prof. Jack Motley
11/16/88	 ASNT Richmond 	50	Mr. Bob Berry
11/29/88	MIT	20	Dr. Allan Budreau
	JAPAN TRIP		Prof. Ken Takagi
12/9/88	USE Symposium Sendai	200	Prof. Ken Takagi
12/12/88	Nippon Steel, Tokyo	30	Prof. Ken Takagi
12/13/88	Tokyo Keiki	120	Prof. Ken Takagi
12/13/88	IECE Lecture, Tokyo	150	Prof. Ken Takagi
1/10/89	•Calverton, MD with ASN	T 100	Dr. Paul Gammell
2/3/89	•William&Mary	100	Prof. Harlan Schone
2/16/89	•VA Am Chem Soc	30	Dr. Billy Upchurch
3/13/89	•Univ. CO		Prof. Subhendu Datta
3/15/89	Palo Alto,CA		Dr. Don Allen
3/30/89	Orlando,FL		Dr. Don Malocha
4/20/89	VPI, VA		Dr. Ashok Sankar
4/27/89	RPI, Troy, NY		Prof. Pankaj Das
5/8/89	NASA, LaRC Lecture Seri	es	Dr. Pat Johnston

I thank the IEEE and my site hosts for the opportunity to meet so many interesting people and to see so many excellent labs. We have a society we can all be proud of reflected in our members!

> J.S. Heyman UFFC-S Distinguished Lecturer