IEEE SOCIETY ON MICROWAVE THEORY AND TECHNIQUES

# NEWSLETTER

EDITOR: *R. S. Kagiwada*
TRW ESG, One Space Park, Redondo Beach, California 90278
Number 11

## OUTGOING PRESIDENT'S REPORT

*by Harlan Howe, Jr.*

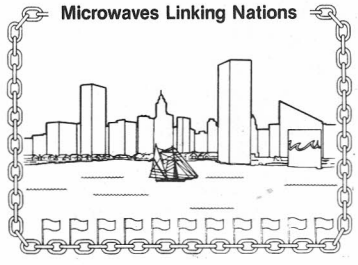
As 1985 draws to a close I have come to the realization that this has been an extremely busy year for MTT-S activity. It has also been a year that has passed all too quickly. The Microwave Theory and Techniques Society is one of the strongest, fastest growing Societies within the IEEE. During the past year, our membership continued to grow and, in fact, increased by 8.8% to a total of 8,475 members as of November 1985. Here in the United States new Chapters were established in Cleveland, Ohio, Dayton, Ohio and the San Fernando Valley, California. In addition, the Tucson, Arizona Chapter was reactivated. New Chapters were also formed in West Germany and Spain. At the present time, Chapters are under formation in the United Kingdom, Brazil, and Venezuela. This increase in membership and the establishment of new Chapters throughout the World is a clear demonstration of the vitality of our Society. That vitality also extends to our financial affairs. Our surplus continues to grow primarily due to the activities of our Symposia and at a time when many IEEE Societies are having financial difficulties the MTT-S stands out as a prime example of a well managed Society.

During the past year, a number of educational support and scholarship programs were put in place. These are described in a special article elsewhere in this Newsletter. The undergraduate scholarship program has been instituted but is still subject to some controversy and is likely to be modified in the near future. Nevertheless, I feel this is an important first step in establishing what we hope will become a comprehensive educational and scholarship program within the framework of the MTT for the benefit of our members and the profession as a whole.

On the international front, we supported a very successful conference by the Brazilian Microwave Society held this past summer in Sao Paulo, Brazil. We recently negotiated an exchange program with the European Microwave Conference which will see its first implementation in June at our International Symposium in Baltimore. This program provides an exchange of invited speakers for the MTT-S Symposium and European Microwave Conference on selected topics of mutual interest to both meetings. The first participation by MTT-S speakers will occur at the European Microwave Conference in Ireland this September.

During the past year, I had the pleasure of representing the MTT-S on the IEEE Technical Activities Board (TAB). Aside from the beneficial interaction with other Society Presidents, we have seen the adoption of a number of policies pioneered by my predecessors, George Oltman, Dick Sparks, and Charlie Rucker. It has been clear to me that because of our strength and vitality, the opinions and positions of the MTT-S are respected by TAB and I expect that this will continue in the future.

Finally, I would like to express my appreciation for the opportunity and the honor of serving as President of the MTT-S and to thank those many people who provided active support to the Society as a whole and to me personally in the past year. I am confident that the same support will be extended to Reinhart Knerr our new President and I wish him well.



# DIVISION IV DIRECTOR'S REPORT

*by Kiyo Tomiyasu*

At its meeting on November 24, 1985, the IEEE Board of Directors elected 170 IEEE Senior Members to the Grade of Fellow, effective January 1, 1986. MTT-S Senior Members elected were:

| | |
|---|---|
| Constantine A. Balanis | James C.I. Lin |
| Colin K. Campbell | Robert J. Mattauch |
| Kenneth L. Carr | David N. McQuiddy, Jr. |
| Keith R. Carver | J. Barry Oakes |
| William F. Croswell | Barry S. Perlman |
| James E. Degenford | Jorg E. Raue |
| Timothy T.J. Fong | Glenn S. Smith |
| John B. Horton | Michio Takaoka |
| Gideon Kantor | Martti E. Tiuri |
| Ray J. King | Andre S.J. Vander Vorst |

Congratulations to these new Fellows!

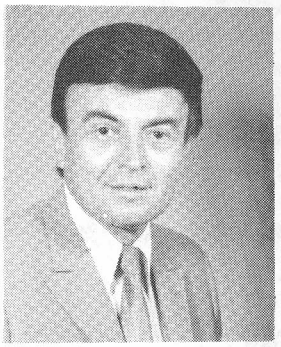
The 1985 IEEE Fellow and Senior Member Index was recently published with a very limited distribution. These members are listed by Sections within Regions and by Society memberships. It is to be used in conjunction with the IEEE Membership Directory which contains addresses and telephone information. This 238-page index has been distributed to Society Presidents, Society Membership Committee Chairmen and Society Awards Committee Chairmen. The Index has also been distributed to Section Chairmen, Section Membership Committee Chairmen and Section Awards Committee Chairmen. Two possible uses of this Index are 1) to answer inquiries from members who may be seeking potential references for applications for Senior Member Grade, and 2) for potential nominations for IEEE awards. Extra copies of this Index are not available and it is not for sale.

On August 19 MTT-S Historian Ted Saad received a medal for the best Centennial Transactions. He was the Guest Editor of the September 1984 issue of the IEEE TRANSACTIONS ON MTT, entitled "Historical Perspective of Microwave Technology." Our congratulations to Ted for a difficult task well done.

I hope the MTT-S membership noted the recent Fall 1985 issue of the MTT NEWSLETTER. It was 72 pages long and packed with interesting items. It was the result of a great deal of effort on the part of our MTT NEWSLETTER Editor Reynold Kagiwada with the able assistance of Cindy Yokono. It is hard to express sufficient gratitude to them for their contributions to MTT activities.

It is unbelievable that one-half of my two-year term as your Division Director has already passed. It has been a rewarding experience and a great pleasure to witness so many volunteers enthusiastically supporting our engineering profession.

# ADCOM HIGHLIGHTS



*by Reinhard H. Knerr*

The Fall Meeting of MTT-S ADCOM has traditionally been the meeting that is dominated by the elections. We always have a large number of very qualified people compete for very few openings. Traditionally we reelect our members if they served less than three terms, which effectively opens one or two slots every year. We are fortunate to be able to draw from such a large pool of qualified, interested MTT members which is, in my opinion, a result of us being a successful, dynamic society.

Welcome to our new ADCOM members:

Peter Staecker
Mario Maury, Jr.

and our re-elected members:

Walt Glenovatch
Paul Greiling
Ferdo Ivanek
Reynold Kagiwada
Dave McQuiddy (Vice President)

We have two Distinguished Lecturers in 1986: John Bryant's lecture is entitled: "The First Century of Microwaves — 1886 to 1986".

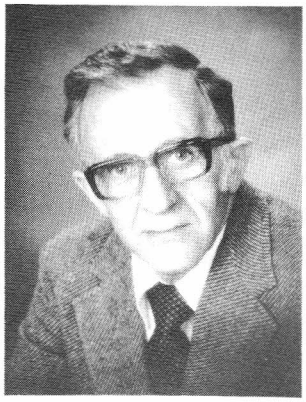
We are fortunate to have somebody of Dr. Bryant's stature agreeing to serve. I look forward to hearing this talk.

Ed Niehenke's lecture is entitled: "GaAs-Key to Modern Microwave Technology".

I know from past experience that Ed is a dynamic speaker and knows how to capture the attention of his audience.

It is also interesting to note that the Historic Committee has purchased video recording equipment. I am very pleased that George Jerinic accepted the chairmanship of a subcommittee which will use the equipment to interview some of the pioneers in our field as a historic record. He also plans to have an edited version to be used at our Historic Exhibit. I think this is a great idea, and I am sure that John Bryant's Distinguished Lecture will give George a lot of inputs.

# THE MTT HISTORICAL COLLECTION



*by Ted S. Saad*

It seems such a short time ago that Steve Adam, then Adcom President, declared "there will be an MTT Historical Exhibit." Last June in St. Louis, we were able to present the 6th annual MTT Historical Exhibit. Helping us in St. Louis, we had the good fortune of having Professor Harold Shipton of the EE Department at Washington University in St. Louis as the Historical Exhibit representative on the Symposium Steering Committee.

The size of the exhibit has grown steadily. Our permanent collection, which started at 19 artifacts in 1979, is now up to 74 pieces, with promises of at least 15 more valuable artifacts to be added before Baltimore. Our book collection numbers 60 and we expect more in the near future.

Interest in the exhibit continues to grow. In particular, our video theatre has been attracting large audiences. We now have 6 video tapes, including 2 on Nikola Tesla, one of Mrs. Varian talking about her husband and his brother, a British tape on Radar Development from Herz to the present day, the "Miracle Force" tape of the IEEE and a Phased Array Radar tape from Raytheon.

Although it is still early, we hope to divide our Historical Exhibit during the Baltimore Symposium into 3 separate areas. One will be devoted to the video theatre, the second will contain the artifacts and the third will contain the book collection

Our representative on the Symposium Steering Committee will be Mel Zisserson of Amecon.

In the meantime, I am still looking for items to add to the collection. Many of you have old microwave items that you probably think have no historical value. To answer the question of historical value, ask one of your young engineers if he knows what it is or has ever used it. If the answer to either question is no, you have a historical artifact. If you aren't sure, call me.

You are aware, of course, that most young engineers have never seen a slotted line, or adjusted a sliding screw tuner, or tuned a triple stub tuner — all historical artifacts.

If you send me an artifact, a book, or a video tape, please include a detailed description of the item. Your name, along with the description, will be placed next to the artifact at the next exhibit.

If you have any questions, call or write to:

Ted Saad
Sage Laboratories, Inc.
3 Huron Drive
Natick, MA 01760
617-653-0844

Remember to visit us in Baltimore in June 1986.

# EDITORS NOTES

*by R.S. Kagiwada*

It only seems like yesterday that Harlan had become the new MTT-S president. 1985 was really an eventful year and went by extremely quickly. Under the reign of Reinhard Knerr, the new president, 1986 promises to also be packed with events and excitement. Already there is excitement in the air about the upcoming Microwave Symposium in Baltimore. I am sure the people that are able to go this June to Baltimore will find it to be a memorable occasion. Ed Niehenke's committees have been working extremely hard for over three years.

John Horton has done an outstanding job in providing a series of articles. They have been very informative, excellent microwave papers. His Special Article is an important part of our Newsletter. S. Jerry Fiedziaszko's Special Article on "Microwave Dielectric Resonators" presents the state-of-the-art survey of this field. I am sure you will enjoy reading it.

The Newsletters intention is to service the needs of the MTT-S members. We encourage your thoughts and hope to hear from you.

A SPECIAL Issue of the MTT Transactions on the subject of "Microwave Aspects and Applications of GHz/Gbit Optical Technology" will be published in March 1987. Deadline for manuscripts is July 1, 1986.

FOR MORE DETAILS CONSULT THE FEBRUARY ISSUE OF THE TRANSACTIONS.

# ADCOM ELECTIONS

*by Walt Gelnovatch*
*Adcom Nominations*
*Chairman, 1986*

The annual fall election meeting of MTT-S was held in Long Beach, California on October 14, 1985. A total of 7 dedicated people were elected to ADCOM membership. Six were elected to three year terms and one to a two year term. The elected members were Dave McQuiddy, Reynold Kagiwada, Ferdo Ivanek, Paul Greiling, Walt Gelnovatch. Newly elected was Mario Maury, Jr. All will serve 3 year terms. Elected to a 2 year term, filling the slot vacated by Harlin Howe, was Peter Staecker. The re-elected members have demonstrated an excellent track record of service to the greater heights in the future.

The new members will bring with them innovative fresh approaches and ideas.

In order that you may meet these newly elected officials, their bio-sketches are presented below. The bio-sketches of those re-elected have been included in past newsletters, Mario Maury, Jr., and Peter Staecker.

**MARIO A. MAURY, JR.**

Mario Maury was born in Havana, Cuba on July 21, 1936 and immigrated to the U.S.A. in March, 1945. He attended Mt. San Antonio College and California State College at Los Angeles. Mr. Maury is currently President, CEO and Chairman of the Board at Maury Microwave Corporation, Cucamonga, California, where he was part of the founding group in 1957.

Mr. Maury started his career at General Dynamics — Pomona, California, as a Jr. Engineer and in 1961 left to join Maury on a full time basis. He has designed a wide variety of passive microwave components and instruments in coaxial, waveguide and strip line structure from literally DC to 110 GHz, such as; directional couplers, adapters, terminations, tuners, etc. Mr. Maury has been actively involved in the development of calibration standards for Automatic Network Analyzers, precision noise measurement equipment, transistor test fixtures and precision and high frequency coaxial connectors.

Mr. Maury was responsible for the design of the first commercial coaxial connector to operate mode free to 40 GHz in 1973 and then to 60 GHz in 1974. In 1984-85, he lead the effort which has resulted in a series of improved millimeter waveguide flanges that has made a significant contribution to the state-of-the-art. Mr. Maury has authored and presented numerous technical papers (several invited) on a wide variety of topics such as; precision coaxial connectors, transistor measurements, microwave measurements and most recently, millimeter flanges and precision measurements techniques.

Mr. Maury is a member of IEE, MTT-S, IMS, ARFTG and AOC.

He became a member of MTT-S in 1968 and started to become active in society activities in 1980. In 1981 he became chairman of MTT-12 Automatic RF Techniques which provides the co-ordination function for that group and still serves in that capacity today. Mr. Maury has served as a member of the MTT-S Symposium Technical Program Committee continuously since 1982, and he is a member of the Editorial Review Board of the IEEE Transactions on Microwave Theory and Techniques also since 1982. He chaired the workshop "High Frequency Coaxial Connectors - 40 GHz and Beyond" at the 1984 Symposium. He is a member of the 1989 Symposium Steering Committee and currently serves as Chairman of the MTT-S Adcom Publicity/Public Relations Committee, an office he was appointed to in 1984.

Mr. Maury serves as Secretary/Treasurer of the MTT-S Adhoc Committee to Promote National Microwave Standards (PNMS). This committee is involved in creating a strong microwave standards activity in the U.S.A. by supporting NBS in order to accomplish national objectives. Mr. Maury was instrumental in the founding of this committee in January of 1984 which is now starting to have a positive impact with Congress and NBS.

Mr. Maury has been a member of ARFTG since 1972 and was originally elected to the Executive Committee in June, 1979 where he has served continuously to date. He has served ARFTG in a variety of capacities; he has been Chairman of the Awards, Publications, Elections and Publicity Committees, as well as a member of others. He served as President from June 1980 through June 1982, during his tenure, membership grew from approximately 100 to over 400. Under his leadership the following were initiated; formal awards (1981), a professional banquet (1981), post conference digest (1982) and vendor exhibits (1985). He served as Conference Chairman for the ARFTG 10th Anniversary - 20th Conference in November 1982 and was Technical Program Chairman for the 23rd Conference in June 1984. He currently serves ARFTG as member of EXECOM, MTT-S Co-ordinator, Exhibits Co-ordinator and he will be the Host for the 26th Conference in December 1985.

Mr. Maury is a technical expert on the U.S. National Committee of the International Electrotechnical Commission (IEC) - SC46D on RF connectors. He is also a member of the Editorial Review Board of the Microwave Journal.

Mr. Maury has received a number of technical and professional awards. In November, 1983, he received the ARFTG Distinguished Service Award for "Outstanding Leadership and Service". In June, 1984, he received the HP Honored Contributor Award for his contributions to the HP8510 Automatic Network Analyzer.

**PETER W. STAECKER**

Peter Staecker received BS and EE degrees from MIT in 1964 and 1968, respectively, and the PhD in Electrical Engineering from the Polytechnic Institute of Brooklyn in 1970. Since 1972 he has been a member of the technical staff at MIT Lincoln Laboratory, Satellite Communications Division. For the past 8 years he has been active in microwave circuit design, developing space-qualified microwave active and passive hardware.

Dr. Staecker is active in MIT-Society activities, having served as 1981-82 Boston Chapter Chairman, and Special Sessions Chairman for the 1983 MIT-S Symposium in Boston. He has served on MTT-S Symposium Technical Program Committees, and is the General Chairman of the 1991 MTT Symposium Steering Committee.

☐ **Competence on the job** cannot overcome bad chemistry—a personality conflict with other executives in the company, particularly the boss. A candid, conciliatory management style, for instance, may only lose you respect in a more aggressive, conspiratorial environment. *Recommended:* If you can't fit in with the corporate culture, the best way to preserve your self-confidence (and your career) is to leave.

Patricia O'Toole, author of *Corporate Messiah: The Hiring and Firing of Million-Dollar Managers,* William Morrow & Co., 105 Madison Ave., New York 10002, $15.95.

# MEMBERSHIP SERVICES

*by Ed Niehenke*

## MTT-S Chapter Support

At the Fall MTT-S ADCOM meeting, the Orlando's Chapter request for $500 to support the IEEE Student Chapter at the University of Central Florida for a satellite communication project was approved. MTT-S ADCOM also recently approved $1000 to the Middle and South Italy chapter to help support their April 2-4, 1986, Millimeter Wave Workshop. In 1985, MTT-S provided $300 to $350 each to 17 chapters for such items as student paper cash prize, newsletter costs, publicity costs for local symposia, chapter expenses, mini-shows, etc. The MTT-S ADCOM is very supportive of projects like this and chapters are encouraged to submit requests to the Membership Sevices Chairman. Expenses up to $350 can by approved by the Membership Services Chairman, while higher expenses require MTT-S ADCOM approval.

## New Chapter Formation

A request was recently approved by MTT-S for the formation of the Dayton MTT/AP joint Chapter. The United Kingdom, Rio de Janeiro, and Venezuela are in the formation process.

A Chapter, either MTT-S or jointly with another Society, can be formed by having at least 12 Society members above the Student grade in the area sign the petition and have it approved by their local IEEE Section and by the respective Society. The petition and the names, addresses, and telephone numbers of local Society members can be obtained from the IEEE Services Center, (201) 981-0060. The address is:

IEEE Services Center
445 Hoes Lane
Piscataway, NY 08854

## Swiss MTT-S Chapter

The Swiss MTT-S Chapter is two years old. Congratulations to the Chapter members, the Chapter officers, and to Professor Fred Gardiol who successfully led the Chapter as Chairman for the first two years. The newly elected 1986-87 officers of the Swiss Chapter are as follows:

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|---|---|
| Chairman: | Mr. Ray Ballisti |
| Vice Chairman: | Dr. Felix Nyffeler |
| Secretary-Treasurer | Mr. Jean-Francois Zürcher |

Professor Fred Gardiol has an interesting observation about microwaves in Switzerland. Most researchers are generally aware, through publications and conferences, of the new achievements in the field on a worldwide basis, but all too often they don't know what is happening next door. It is the desire of the Swiss Chapter to set up close ties between the microwave people within Switzerland itself.

## New Membership Services Chairman

It has been a pleasure serving as the MTT-S Membership Services Chairman over the past few years. At the last MTT-S ADCOM meeting I was nominated as one of the two 1986/87 Distinguished Microwave Lecturers. The title of my lecture is "GaAs - Key to Modern Microwave Technology." This honored lecturer position as well as my job as Chairman of the 1986 Microwave Symposium will keep me busy with MTT-S in 1986.

The new Membership Services Chairman is Martin V. Schneider and the Co-Chairman is Steven J. Temple. Please contact Martin or Steve for any assistance at the following addresses:

Martin V. Schneider
AT&T Bell Laboratories
P.O. Box 400
Room HOH L261
Holmdel, NJ 07733
(201) 949-2503

Steven J. Temple
Raytheon Company
Missile Systems Division
Mail Stop M15-50
Bedford, MA 01730
(617) 274-7100, ext 4736

## Distinguished Microwave Lecturers

The 1984/85 Distinguished Microwave Lecturers, Dr. Paul Greiling ("High Speed Digital IC Performance Outlook") and Dr. Sander Weinreb ("Radio Astromony — A Challenge to the Microwave Engineer") have essentially completed their lectures, collectively visiting 86 groups throughout the world.

Mr. Kenneth Carr, the 1985/86 Distinguished Lecturer, has had an overwhelming number of requests from MTT Chapters, IEEE Sections, universities, and institutes from all over the world for his lecture, "The Application and Treatment of Cancer Using Microwave Technology." He has been active visiting 20 groups in 1985 with many more planned in 1986. (see Mr. Carr's report.)

Two Distinguished Lecturers have been selected for 1986/87. The first is Dr. John H. Bryant, who will lecture on "The First Century of Microwaves, 1886 to 1986: A Historical Perspective of Microwave Devices and Their Uses." The second Distinguished lecturer is Mr. Edward C. Niehenke who will lecture on "GaAs — Key to Modern Microwave Technology." To arrange for the lecturers, contact them as follows:

Dr. John H. Bryant
Adjunct Research Scientist
Department of Electrical Engineering
and Computer Science
The University of Michigan
Ann Arbor, MI 48109
(313) 764-2390

Mr. Edward C. Niehenke
Westinghouse Electric Corporation
P.O. Box 746, MS-339
Baltimore, MD 21203
(301) 765-4573

# MEMBERSHIP MATTERS

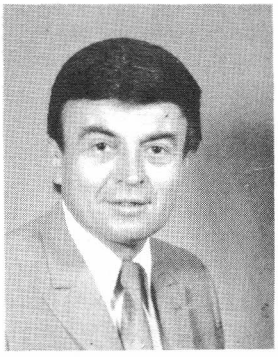
*by Patrick A. Green*

1985 has continued to be another record breaking year for MTT-S membership. Response worldwide has been overwhelming making our goal of achieving 8750 active members by years' end very promising. Already this year MTT-S has acquired 689 new members bringing the total membership to 8475 strong, an increase of 8.8%. This increase has MTT-S in a solid 6th ranked position out of 32 IEEE Societies. Overall, the Institute membership growth rate was 4.7 percent while Society membership increased by 4.8%.

To make it easier to join IEEE, the $15.00 entrance fee will be dropped. Inform friends, get them involved with IEEE. Free MTT-S membership is available for new IEEE members and current IEEE members who are not with the MTT-S.

It has been the policy of MTT-S to recognize MTT-S Chapters with the highest percentage annual membership increase, one from Regions 1 through 6 and one from Regions 7 through 12. Each Chapter receives $200 as well as a plaque, which are presented at the annual MTT-S Chapter Chairmens Dinner at the Microwave Symposium. Each year only small chapters have won the recognition. Beginning in 1986, the number of recognitions will be doubled considering both large chapters as well as small chapters with the dividing line set at the average chapter size for that year.

# INCOMING PRESIDENT'S REPORT



*by Reinhard H. Knerr*

As the new President of MTT-S, it is a real pleasure to thank our 1985 President, Harlan Howe, on behalf of MTT-S for having provided excellent leadership. He will be a hard act to follow.

One major job of the President is to chair our Society's Administration Committee Meeting which implies a position of impartiality and a responsibility to cover all agenda items in a timely manner. This requires cooperation and discipline on the part of the ADCOM Members, an attribute they always had. In all my years on ADCOM, I have seen great enthusiasm by its members to tackle MTT-S's problems. The problems have changed though; while we could spend hours debating whether or not we could afford to publish 800 or 900 pages in our Transactions, this specific matter has become trivial in view of our present affluence, but other problems have become more complex.

If I were allowed to make a wish how I, as your President, would like to see ADCOM do more of, then I would like its members to consider an issue that many corporations, the management of which rose from their engineering staff, face as well. The issue is stated by the following over-simplified statements:

Stop designing, especially at ADCOM Meetings, do more managing.

Delegate, and trust the judgment and recommendation of a properly appointed, qualified subcommittee.

Don't change your decision every time a new, outside input occurs, especially if its only novelty is the person who presents it.

No real world solution is perfect, be willing to propose and accept compromises.

I do know that we have considerable management skills in our ADCOM and my plea to further motivate its application is amplified by the fact that we meet only three times a year. If we are to accomplish our goals in a timely manner, these meetings have to be occasions where decisions are made based on work done between formal meetings.

Obviously, I like to apply this to our main problem, the handling of our surplus which will, if we don't do anything about it, be closely scrutinized by the IRS. We have, after years of debate, implemented a scholarship and research grant problem which is presented in detail in this issue of the Newsletter. As I said in a previous column, this is a historic step, but it only scratches the surface of our affluence. It is not perfect, but it is a start, and instead of spending meeting after meeting to "design and redesign" all the details, let's look forward to a larger even more comprehensive plan.

For this reason, I have asked Dave McQuiddy, our Vice President, to form a subcommittee to take another look at our surplus and come up with a comprehensive proposal on how to use it for the benefit of our Society and our members.

This is not the first attempt to do this, but I sensed that many of the more experienced ADCOM and Ex-ADCOM members are very encouraged that we finally took the first step by implementing our scholarship program and are now willing to go one step further.

I know that Dave McQuiddy and I can count on ADCOM's cooperation and look forward to work with ADCOM to have a successful 1986 in the spirit of serving our profession and members in a responsive and responsible manner.

# BYLAW CHANGES

*by Walter Cox*

At a recent meeting of the MTT-S Administrative Committee the MTT-S Bylaws were amended to change the time period for selection of the Microwave Prize. This paper is "awarded to the author of the paper, published in the IEEE Transactions on Microwave Theory and Techniques Proceedings of the IEEE or other official IEEE publication, which is judged to be the most significant contribution in the field of interest of the Society."

The Bylaws were amended as follows:

Previous wording:

> "The paper must have been published during the year ending June 30th preceding the award."

Revised wording:

> "The paper must have been published during the period January 1 to December 31 of the year preceding the annual meeting of the Administrative Committee at which the award is considered"

The annual meeting of the Administrative Committee at which this award is considered is normally held in October.

Other modifications to the Bylaws and Constitution are in progress. The complete amended Bylaws and Constitution will be published in the Newsletter in the near future.

# AWARDS

*by Don Parker*

Recipients of three major MTT-S awards for 1986 were selected at the ADCOM meeting in October.

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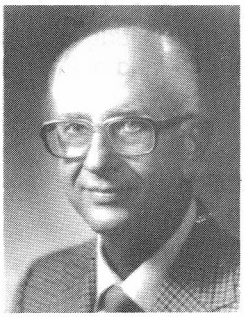
|---|---|
| George L. Matthaei | Microwave Career Award |
| C. Burke Swan | Microwave Applications Award |
| Harold Sobol | Distinguished Service Award |

The recipient of a fourth major award, The Microwave Prize, will be selected at the January 1986 ADCOM meeting. The presentation of all four awards will be made at the 1986 International Microwave Symposium in Baltimore, Maryland next June.

**MICROWAVE CAREER AWARD**

The Microwave Career Award is the highest award given by the Microwave Theory and Techniques Society. It is given to an individual for a career of meritorious achievement and outstanding technical contribution in the field of microwave theory and techniques. The eligibility requirements are publication in technical journals, presentations of lectures, and a distinguished career of contributions to the microwave field. This award is given only to those individuals who have distinguished themselves over a long period of time.

The award consists of a suitable certificate, a plaque, a cash sum of two-thousand dollars, and a feature publication in the **IEEE Transactions on Microwave Theory and Techniques.**



**G.L. MATTHAEI**

Dr. Matthaei's professional specialities are microwave and acoustic devices and network synthesis. He is currently doing research in the area of millimeter-wave integrated circuits. He has published approximately 80 articles on his research in the areas of network synthesis, wide-band impedance-matching structures, microwave filters, parameteric amplifiers, quasi-optical filters, acoustic bulk-wave and surface-wave devices, and most recently dielectric-waveguide filter and coupler techniques for mm-wave and optical integrated circuit applications. In 1961 he was awarded the Microwave Prize for his paper "A Study of the Optimum Design of Wide-Band Parametric Amplifiers and Up-Converters." He is coauthor or contributor to six books. The most widely known of these is **Microwave Filters, Impedance-Matching Networks and Coupling Structures,** which he coauthored with L. Young, and E.M.T. Jones.

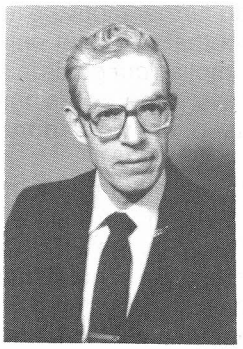
George L. Matthaei was born August 28, 1923, in Tacoma, Washington. He received the BS Degree in 1948 from the University of Washington. The MS Degree in 1949, and the PhD in 1952 in electrical engineering from Stanford University. Dr. Matthaei was a Research Assistant in the Electronics Research Laboratory of Stanford University from 1949 to 1951. From 1951 to 1955 he was first an Instructor and then Assistant Professor in the Division of Electrical Engineering at the University of California Berkeley. He was on the Technical Staff of Ramo-Wooldridge Corporation from 1955 to 1959 where he was engaged in system analysis and research in microwave components. In 1958 he joined Stanford Research Institute where he conducted research on microwave devices. He served as a Project Leader, and in 1962 became Manager of the Electromagnetic Techniques Laboratory of SRI. While at SRI he taught part-time at Stanford University. In July 1964, Dr. Matthaei joined the Department of Electrical Engineering of the University of California at Santa Barbara where he is a Professor.

Dr. Matthaei is a Fellow of the IEEE and a member of MTT-S, AP-S, Sonics and Ultrasonics, Sigma Xi, and Tau Beta Pi. He has served a term on the ADCOM of the MTT-S and also on the ADCOM of Circuit Theory. He is on the Editorial Board for the **IEEE Transactions on Microwave Theory and Techniques** and the journal, **Wave Electronics.** Dr. Matthaei received an IEEE Centennial Medal at the 1984 International Microwave Symposium in San Francisco.

**MICROWAVE APPLICATIONS AWARD**

The Microwave Applications Award is made to an individual for an outstanding application of microwave theory and techniques. The eligibility requirements are creation of a new device, component, or technique; novel use of a device or component; or a combination of any or all of the above. Publication of a paper is not required.

The award consists of a suitable certificate, a cash sum of one thousand dollars, and a feature publication in the **IEEE Transactions on Microwave Theory and Techniques.**



**C.B. SWAN**

Dr. C. Burke Swan introduced the use of diamond to conduct the heat away from high-power microwave

IMPATT oscillator diodes. This was one of a group of effective measures introduced by him for optimizing the output power, the efficiency, and the reliability of microwave IMPATT diodes. Type-IIa diamond is three-to-five times as effective as copper in conducting heat away from small intense heat sources. He showed that small pieces of diamond, only a millimeter on a side and costing only a few dollars each, could allow power dissipation densities of megawatts per square centimeter in very small area semiconductor devices.

The application of the diamond heat sink, the recognition of the importance of optimizing the heat sink design, and the combination of other contributions resulted in Dr. Swan achieving record power levels and efficiencies for IMPATT diodes over the frequency range 6 GHz to 49 GHz. Dr. Swan authored six papers in 1967 and 1968 which established that the power limitations for IMPATTs were primarily thermal not electrical. His pioneering work helped spark the world-wide thrust on IMPATT development which made these diodes the most important solid-state microwave source in communication and radar until the introduction of the GaAs FETs in the 1970's.

The diamond heat sink was immediately extended to semiconductor lasers by co-workers and this made possible for the first time the CW operation of GaAs lasers at room temperature. Today, in addition to high-power IMPATTs, many high-reliability high-power semiconductor lasers are mounted on diamond heat sinks.

Clarence Burke Swan was born November 9, 1932 and received his BSc Degree from the University of New Brunswick in 1954. He received his MASc and PhD in electrical engineering from the University of Toronto in 1959 and 1963, respectively. He joined AT&T Bell Laboratories at Murray Hill, New Jersey, in 1962. His early work included research on high power harmonic generation with microwave gaseous plasmas, and the first experiments with stacked varactors for higher power and better efficiency. In 1969 he became supervisor of the microwave integrated circuits group at Allentown, Pennsylvania. Since 1978 he has supervised the development of high-bit-rate lightweight transmitters for both terrestrial applications and for the TAT-8 undersea system. He has been granted eight patents and has published more than 20 papers. Dr. Swan is a Senior Member of the IEEE and is a member of the American Optical Society, the Association of Professional Engineers of Ontario, and the American Association for the Advancement of Science.

## DISTINGUISHED SERVICE AWARD

The Distinguished Service Award is made to an individual who has given outstanding service for the benefit and advancement of the Microwave Theory and Techniques Society. The eligibility requirements are service in one or more of the following areas: the Administrative Committee, publications, meetings and symposia, chapter leadership, committee chairman, committee member, editor, lecturer or other distinguished service. Factors which will be considered are: leadership, innovation, activity, service, duration, breadth of participation and cooperation. The individual must be a member of the IEEE and a member of the Microwave Theory and Techniques Society.

The award consists of a suitable certificate, a plaque and a feature publication in the **IEEE Transactions on Microwave Theory and Techniques.**

**HAROLD SOBOL**

Harold Sobol has actively served the MTT-S since 1969 and has made many significant contributions. Of particular note is that while chairman of the awards committee, he implemented the MTT-S Distinguished Service Award with Ted Saad as the first recipient. In all aspects of Dr. Sobol's work for ADCOM he was highly professional and set a standard for all to follow. His extensive and detailed efforts in long-range planning while Vice President were outstanding.

Dr. Sobol was first elected to MTT-S ADCOM in 1972 and served as Chairman Technical Committees, Vice President and President in 1978. He was the Microwave National Lecturer in 1970. He served as Chairman of the MTT-S Awards Committee and currently heads a committee reviewing MTT-S ADCOM Committees. He has served on the IEEE Awards Planning and Policy Committee and was Chairman of the Dallas Section Student Activities Committee for the past two years. Dr. Sobol was a member of the Editorial Board of Spectrum for five years. He served as General Chairman of the 1974 Electronic Components Conference and of the 1975 International Solid State Circuits Conference. He has been a member of Program Committees of the above conferences and of the MTT-S symposium. He was Vice Chairman of the 1973 IEEE INTERCON.

Dr. Sobol also serves on EIA, U.S. Telephone Association, National Science Foundation, and Electromagnetic Energy Policy Alliance Committees. He is a member of Industrial Advisory Committees at the University of Texas at Arlington and the University of Michigan.

Harold Sobol received the BSEE degree from City College of New York and MSE and PhD degrees from the University of Michigan. He has worked on radar, missile guidance, superconducting devices, microwave tubes, plasmas, solid-state device, microwave integrated circuits, and microwave and lightwave communication systems. He was with the University of

Michigan's Willow Run and Electron Physics Laboratories from 1952-1959, IBM Watson Research Laboratory from 1960-1962, and RCA Laboratories from 1962-1973. He joined Collins Radio which was subsequently acquired by Rockwell International in 1973. He served as Director of Product Development for the Collins Transmission Systems Division until May 1985 when he was promoted to Director of Engineering for all of Rockwell's Telecommunications Divisions. He has more than forty publications and has presented more than fifty papers at professional meetings. He is an author and editor of an Academic Press volume on Microwave integrated Circuits. Dr. Sobol was elected Fellow of IEEE in 1973, received an IR-100 Award in 1969 for his work on microwave integrated circuits, received the Dallas IEEE Section Award for Outstanding Engineer of 1975, and was awarded an IEEE Centennial Medal in 1984.

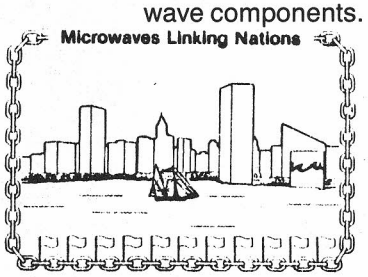
**1986 FELLOW AWARDS**

Nine Senior Members of the Microwave Theory and Techniques Society were elected Fellows of the IEEE. Their election is effective January 1, 1986. We extend congratulations to them.

| | |
|---|---|
| Kenneth L. Carr | For contributions to the application of microwave technology in medicine. |
| James E. Degenford | For contributions to hybrid and monolithic microwave integrated circuits. |
| Timoth Ting-Jau Fong | For contributions to the development of millimeter-wave technology. |
| John B. Horton | For leadership in the design of military millimeter-wave systems. |
| James Chih-I. Lin | For contributions to understanding the biological effects of pused microwaves in the inner ear of humans. |
| Robert J. Mattauch | For contributions to the development of low-noise millimeter-wave diode technology. |
| David N. McQuiddy, Jr. | For leadership in the development of solid-state modules for phased arrays. |
| Barry S. Perlman | For contributions to microwave solid-state device and circuit design, and leadership in computer-aided methods of microwave engineering. |
| Jorg E. Raue | For contributions to the development of millimeter-wave components. |

The candidacy of the above Fellows was endorsed by the Microwave Theory and Techniques Society. Eleven other members of MTT-S who also hold membership in other societies of the IEEE were elected to rank of Fellow based on their other Society's endorsement.

| | |
|---|---|
| Constantine A. Balanis | For contributions to electromagnetic education, geometrical theory of diffraction, and electromagnetic geotomagraphy. |
| Colin K. Campbell | For contributions to surface-acoustic-wave devices and electrical engineering education. |
| Keith R. Carver | For leadership in microwave remote sensing. |
| William F. Croswell | For leadership in spacecraft and aircraft antenna research and design. |
| Gideon Kantor | For leadership and contributions to microwave and radio-frequency diathermy and hyperthermia. |
| Ray J. King | For contributions to the theory and experimental modeling of radio wave propagation over nonuniform surfaces. |
| J. Barry Oakes | For leadership in the application of electrical measurement instrumentation. |
| Glenn S. Smith | For contributions to the analysis and measurement of the electromagnetic characteristics of antennas in matter. |
| Michio Takaoka | For contributions to theoretical design and development of high-voltage cable. |
| Martti E. Tiuri | For contributions to the theory and techniques of microwave radiometers and microwave applications in remote sensing and industrial instrumentation. |
| Andre S.J. Vander Vorst | For contributions in atmospheric microwave propagation, satellite communication earth station design, and numerical analysis of microwave components. |



# 1986 IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM: MICROWAVES LINKING NATIONS

*by Ed Niehenke*

The 1986 International Microwave Symposium will be held in Baltimore, Maryland, from Monday, June 2, to Wednesday, June 4, 1986. The Monolithic Symposium will be held jointly with the Microwave Symposium on Wednesday afternoon and all day Thursday, June 5. The Automatic RF Techniques Group (ARFTG) conference will be held on Thursday and Friday, June 5 and 6. Workshops are planned for all day Thursday and Friday, June 5 and 6. Panel sessions are planned for Monday noon, Tuesday noon, Monday evening, Wednesday evening, and Thursday evening. (See the 1986 Microwave Symposium Schedule.)

The location of the 1986 Symposium is the Baltimore Inner Harbor. The technical sessions and exhibits will be held in the new spacious Baltimore Convention Center. Sleeping accommodations are at 10 modern hotels within walking distance of the Convention Center. We have obtained excellent rates at all hotels - average single $67, average double $76 - and have booked 2300 rooms for the expected record attendance.

The response from our call for papers has been overwhelming. The number of submitted papers has significantly surpassed previous years with many papers from outside the United States. We have received 337 papers so far and expect to receive over 350 papers by our deadline. The number of submitted papers from the last three years number 284 (1983 Boston), 252 (1984 San Francisco), and 270 (1985 St. Louis). The response from the various MTT-S Technical Committees and other groups has been excellent. They have organized six workshops and six panel sessions for the 1986 Sysposium.

Workshops planned for Thursday include: Microwave Procurement, Optical Gigabit Transmission, Dielectric Reasonators, and Future Trends in Microwave CAD. Friday's workshops include: Filters and Multiplexers, and Microwave and Millimeter Wave, and Magnetics.

Panel sessions will start noon Monday with a PACE sponsored session entitled "Issues in Microwave R&D." The evening session will be on Millimeter Wave Systems. Tuesday's noon session will be on manufacturing MIC's. On Wednesday evening, the panel sessions cover GaAs MMIC's and Millimeter Wave Integrated Circuit Sources. The Thursday evening panel session will be on Reliability Enhancement.

This year's Microwave Symposium will include many innovations. We will have two focused ssessions: one dealing with Low-Cost Component Manufacturing, and the other on Microwave Aspects and Application of GHz/Gibt Optical Transmission. An international opening session is also planned with experts from Europe presenting the latest European Microwave technology as part of a reciprocal exchange between MTT-S and the European Microwave Conference. Included in the international opening session is a presentation on Microwave research by the President of the Society of Microwaves from the Peoples Republic of China.

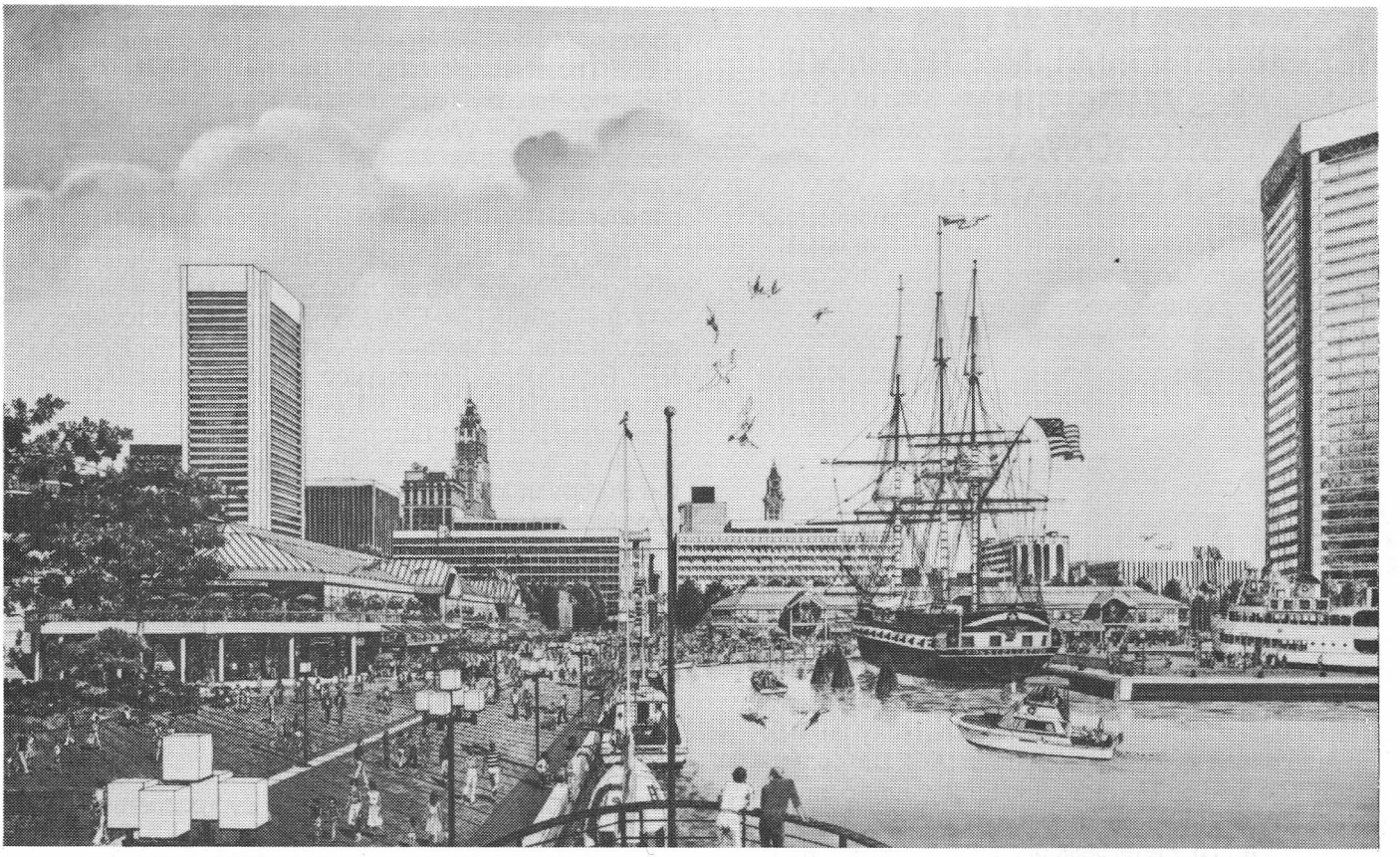
In addition to the fine technical sessions, we will have a substantial commercial exhibit of suppliers of microwave materials, equipment, and services for you to visit. The number of booths in Baltimore is significantly higher than that of any previous symposium.

To complement the fine technical symposium, exciting social events are planned for this year's Symposium. Sunday evening, June 1, from 6 to 8 p.m., Microwave Journal is giving a complimentary cocktail reception party for all the symposium attendees and their families at the Maryland Science Center in the Baltimore Inner Harbor. The entire Science Center will be open exclusively for us. Everyone should plan to arrive in Baltimore in time to attend this function.

Monday the guest program will include two tours, one of the Inner Harbor and one of historic Baltimore. Monday evening has been left without any structured social events so you can go on your own to stroll the beautiful Baltimore Inner Harbor with its many attractions, dine at the many excellent Baltimore restaurants, go for a cruise on the Cheasapeake Bay, take in a play, concert, sports event, or whatever.

The Tuesday guest program will include a visit to historic Annapolis with a tour of the Naval Academy. Preceding the Symposium Awards Banquet, the exhibitors will sponsor a reception in the atrium of the Hyatt Regency from 5:45 p.m. to 7:15 p.m. Complimentary beverage tickets will be distributed to all attendees in their registration package. The Awards Banquet to follow will be an event you will not want to miss this year. We have planned a superb meal and excellent entertainment.

The Wednesday guest tour will visit Washington, DC, and will include the Smithsonian Institution. All technical conference registrants and their families of either the Microwave or Monolithic Symposium are invited to a complimentary Crab Feast/Bull Roast on Wednesday evening. This event is a Baltimore tradition



**Baltimore Inner Harbor, Site of the 1986 International Microwave Symposium**

which we want to share with you. I guarantee you will enjoy it. Thursday evening the ARFTG is holding its banquet at the Sheraton Hotel.

The 1986 Baltimore Microwave Symposium Steering Committee cordially invites you and your families to join us in Baltimore. We have been working hard for a long time to make your stay a pleasant one which will be remembered for years to come. Plan to attend.

**1986 MTT Symposium Schedule**

| June | Su 1 | M 2 | Tu 3 | W 4 | Th 5 | F 6 | Sa 7 |
|---|---|---|---|---|---|---|---|
| **MICROWAVE SYMPOSIUM** | | | | | | | |
| Microwave Journal Reception | E | | | | | | |
| Hospitality Suite | | MA | MA | MA | MA | MA | |
| Speakers' Breakfast | | M | M | M | | | |
| MTT Symposium | | MA | MA | MA | | | |
| Panel Sessions | | NE | N | E | E | | |
| Chapter Chairmen's Dinner | | E | | | | | |
| TPC Lunch | | | N | | | | |
| Exhibitors' Reception Cocktail Party | | | E | | | | |
| MTT Awards Banquet | | | E | | | | |
| ADCOM | MA | | | | | | |
| Workshops | | | | | MA | MA | |
| Guest Program | | MA | MA | MA | | | |
| **MONOLITHIC CIRCUITS SYMPOSIUM** | | | | | | | |
| Speakers' Breakfast | | | | M | M | | |
| Symposium | | | | A | MA | | |
| Crab Feast/Bull Roast | | | | E | | | |
| (Open to Registrants of Either Symposium) | | | | | | | |
| **ARFTG** | | | | | | | |
| Meeting | | | | | MA | MA | |
| Banquet | | | | | E | | |

M - MORNING A - AFTERNOON
N - NOON E - EVENING

# Should I rewind my videotapes?

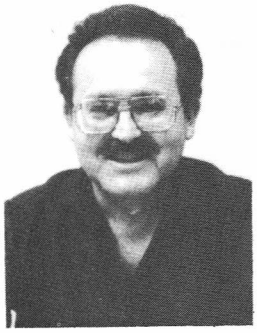
You should always rewind your videotapes to prevent them from stretching unevenly. Leaving a cassette partially wound means that part of the tape is lying loose between the two spools. This section is under less tension and may contract (for a number of complicated reasons, starting with gravity). Your VCR must then vary speeds to "read" the distorted section of the tape, putting wear and tear on the machine. If stretched and unstretched areas occur at different points along a tape, the machine must speed up and slow down for each, causing even more strain.

A rewound tape is wrapped tightly around one spool. Only the leader is loose and subject to contractions. The VCR can adjust easily to distortion at the start of a tape.

After rewinding a cassette, store it upright with the *full* spool at the bottom. This gives the tape maximum support against uneven stretching.

*Bottom Line/Personal* interviewed Lancelot Braithwaite, technical editor, *Video*, 460 W. 34th St., New York 10001, monthly, $15/yr.

# ARFTG HIGHLIGHTS



*By Mario A. Maury, Jr.*

The Automatic RF Techniques Group (ARFTG) is a professional society that is affiliated with MTTS. It is primarily concerned with computer-aided microwave measurements and design. The following is a summary of its recent activities.

**26th ARFTG Conference**

The Fall 1985 ARFTG Conference was held at the Red Lion Inn, Ontario, California on December 5 and 6, 1985. The Conference's main topic was "Computer-Aided Microwave Engineering" and the Conference Chairman was George Oltman, Hughes Aircraft, Canoga Park, California. The local host was Mario Maury, Jr., Maury Microwave Corp., Cucamonga, California.

Ray Tucker of Rome Air Development Command, Griffiss AFB, New York and President of ARFTG opened the meeting and introduced Mario Maury, who welcomed the attendees to sunny Southern California.

The Technical Program Chairman was Gary Simpson of Maury Microwave, Cucamonga, California, who put together an excellent program consisting of 16 technical papers. The following is a partial summary of the papers presented:

—"AUTOMATED SEPARATION OF REFLECTIONS USING ARTIFICIAL INTELLIGENCE,"
J. A. Wilson, W. D. Couper, M/A COM Omni Spectra, Inc., Merrimack, NH

—"SHARED RESOURCE MANAGEMENT WORK STATION FOR MICROWAVE ENGINEERING,"
H. E. Stinehelfer, Sr., Raytheon Bedford Labs, Burlington, MA

—"CAE INTERFACES WITH H/P AUTOMATIC NETWORK ANALYZERS,"
Steven Hamilton, EEsof, Inc., Westlake Village, CA

—"SOFTWARE REUSABILITY: A KEY CONCEPT FOR THE FUTURE,"
Robert D. Atkinson, TRW, Redondo Beach, CA

—"USING PCs AS CONTROLLERS FOR AUTOMATED RF MEASUREMENTS,"
Cliff Morgan, Tektronix, Inc., Beaverton, OR

—"PROGRAMMABLE MICROWAVE TUNER SYSTEM,"
J. L. Schepps, S. M. Perlow, J. E. Brown, RCA Laboratories, Princeton, NJ

—" A STUDY OF CHIP FIXTURE CHARACTERIZATION USING VARACTORS,"
Richard Lane, California Eastern Labs, Santa Clara, CA

—"PRECISION MMW FLANGES IMPROVE VANA PERFORMANCE, 18-110 GHz,"
M. A. Maury, Jr., G. R. Simpson, Maury Microwave Corp., Cucamonga, CA

—"REFLECTION RESIDUALS OF COAXIAL CONNECTORS,"
William Oldfield, Wiltron, Mountain View, CA

The Conference had a well rounded program in addition to the technical sessions which consisted of: a Companions program on both days, Manufacturers Exhibits also on both days and a tour of Maury Microwave Corporation on the afternoon of Friday, the 6th. Manufacturers exhibiting at the Conference are listed below:

| | |
|---|---|
| Adams Russell | Maury Microwave Corporation |
| Anritsu | RCA Laboratories |
| EEsof | Textronix |
| EIP Microwave | Wiltron |
| Hewlett Packard | |

**ARFTG AWARDS BANQUET**

The semi-annual ARFTG Awards Banquet was held the evening of the 5th and the following awards were presented by Ray Tucker, ARFTG President:

Automated Measurements
Career Award . . . . . .Seymour B. Cohn
S. B. Cohn Associates
Los Angeles, CA

Automated Measurements
Technology Award. . . . . .William W. Oldfield
Wiltron Company
Mountain View, CA

Service Award . . . . . .Jim L. Taylor
Bendix
Kansas City, MO

Best Paper, 24th Conference . . . . . .J. Robert Ashley
Sperry
Clearwater, FL

Conference Host Award,
26th Conference . . . . . .Mario A. Maury, Jr.
Maury Microwave Corporation
Cucamonga, CA

The Banquet Speaker was Bill Blume from Jet Propulsion Laboratories, Pasadena, California. His topic was "Halley's Comet" which is extremely timely and was of considerable interest to the audience. Entertainment for the evening was provided by Joel Bauer, "Outrageous Comedy and Innovative Magic"—and it was outrageous!

**ANNOUNCEMENT 27th CONFERENCE**

The Spring ARFTG Conference will be held as a workshop as part of the 1986 MTTS International Microwave Symposium. The Conference will be held on June 5 and 6, 1986, at the Sheraton Hotel in Baltimore, Maryland. Advance registration is recommended utilizing the symposium registration form, although attendees can register directly preceeding the Conference.

The theme of the Conference will be "Pulsed-RF Automated Measurements." Papers are solicited on recent hardware and software developments on this topic, as well as other computer-aided RF design and testing topics. Technical presentations will be informal 25 minute talks using viewgraphs or 35mm slide illustrations. Manufacturers are also encouraged to discuss or demonstrate new products that have been developed for RF design and testing, a separate exhibits area will be available for demonstrations. Authors should submit a one page abstract and a 500 to 1,000 word summary with attachments containing illustrations, etc., providing sufficient technical content to properly evaluate the paper's contribution and its usefulness to the Conference attendees. Two copies of the abstract and summary should be sent to the Technical Program Chairman before March 28, 1986. All accepted papers will be published in the Conference Digest. Please refer to the "ARFTG Instructions to Authors" for additional information.

Submit papers to the Technical Program Chairman (TPC):
Jim Manning
Westinghouse Electric Corporation
P.O. Box 746, MS 282
Baltimore, MD 21203
(301) 765-6109

Manufacturers interested in exhibiting their products, contact the Assistant Exhibits Co-ordinator (EC):
Darlene Payette
Maury Microwave Corp.
8610 Helms Avenue
Cucamonga, CA 91730
(714) 987-4715, x45

For further information, contact the ARFTG Conference Chairman (CC):
Richard Irwin
Systems for Automatic Test
420 Persian Drive
Sunnyvale, CA 94089
(408) 734-9447

☐ **Winning ways.** Always act confident, no matter how you feel. Never stand still. Take the initiative and the risk. Seize your opportunities. Always press your advantage to the full. Do the unexpected—it will keep your opponent off balance. Bluff occasionally to keep your opponent guessing. *Goal:* Respect, not love. Know when to retreat in one area to gain an advantage in another. Learn from your mistakes—don't make the same one twice.

*Tactics* by Edward de Bono, Little, Brown & Co., 34 Beacon St., Boston 02108, $17.95.

# 1989 INTERNATIONAL MICROWAVE SYMPOSIUM, LONG BEACH, CALIFORNIA

*by Chuck Swift*

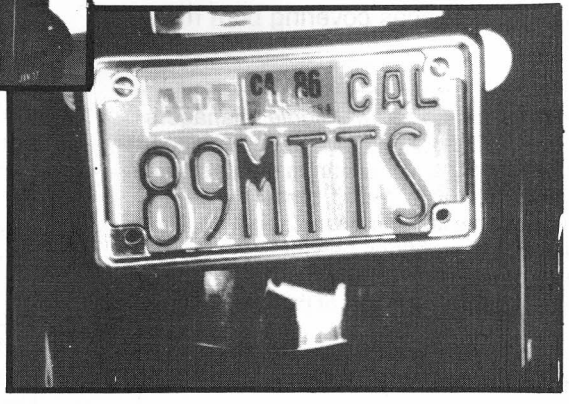
As the Chairman for the 1989 MTT/S, I have four years in which to find innovative ways in which to hold the Symposium. This year, two major events were held in St. Louis, the 1985 Symposium and the World Series, and it was while watching the latter that it occurred to me I might find something which could be incorporated into our 1989 program.

First, I'd like to have the Budweiser Clydesdale's at our Cocktail party, which is tentatively planned under the wing of the Spruce Goose. Big plane, big horses. There might be a small clean-up problem, but I already have a couple of customers in mind to place on the "Clean-up Committee". Certainly, the Clydesdales are a big draw (that's a pun, son), and Budweiser might be convinced the publicity value would be enough to have them underwrite the cost of the beer. What the hell, that's how the Olympics, held in the same area, came out with a giant surplus.

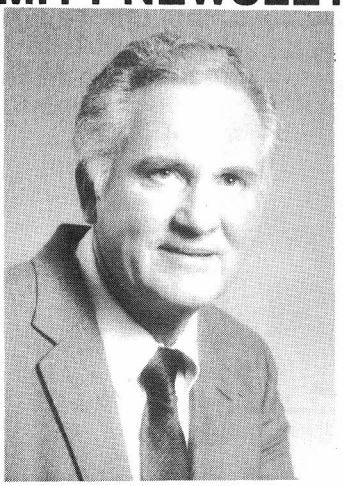
Next, I'd like to provide the speakers with chewing tobacco. As you know, the last few years smokers have been asked not to smoke in the meeting rooms, but chewing tobacco doesn't have the same stigma, at least as far as endangering the health of the person next to you. Spot your suit or tie, maybe, but it won't damage the lungs. We could get some real close-ups, ala TV, showing the speaker hitting the cuspidor from 10-15 feet, which we could get run in the trade publications. Rather than "Best Microwave Paper", we might give an award for the "Greatest Distance", or "Greatest Accuracy". I know the public is interested, because half the footage of the World Series seemed to be of some ball player spitting (expectorating).

Now, for my biggest innovation. The Speakers can belly-up, or chest-up, to the Session Chairman, if they think he has done anything to upset their presentation, like having the slides shown upside down, or out of focus. Point fingers, go nose to nose, then stalk back to your room and break the mirrors in the bathroom. Great stuff! Belittle them at the next conference you attend, saying they got the PHD at Amherst. Whatever the speaker does, he is not to accept any blame himself for his poor performance. After all, baseball is the American way, and we need to adopt more of these attitudes which are revered by the American public.

# LONG BEACH 1989 INTERNATIONAL MICROWAVE SYMPOSIUM SITE/ADCOM REVIEW

# SPECIAL ARTICLES SOLICITED FOR THE MITT NEWSLETTER



*By J. B. Horton*

The MTT Newsletter staff is very interested in obtaining feature articles dealing with current topics in the technical and professional areas of interest to MTT members. The idea is to provide the members with a general understanding of the topic and its significance in current and future activities in the microwave field. I would like to emphasize, however, that these special articles will cover topics in a broad, general sense. Specific design techniques and applications will be covered in papers appearing at the MTT symposia and in the Transactions.

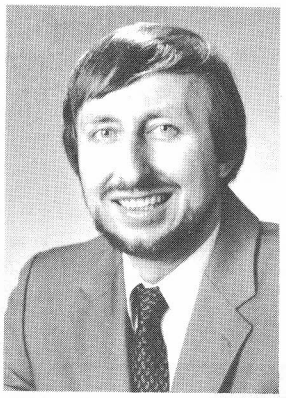
If you know of a topic that is current and/or you are willing to contribute an article to the NEWSLETTER, please contact John Horton (213-535-8372) or Reynold Kagiwada (213-536-2402) at TRW, One Space Park, Redondo Beach, CA 90278.

The feature article for this issue deals with dielectric materials and application of these materials to microwave components. For many years the subject of dielectric materials has interested many scientists and engineers, but serious application of these materials was delayed until temperature stable material was dev ɔloped. Our feature author, Jerry Fiedziuszko, provides us with a historical background and an up-to-date review of the microwave theory involved, and some of the current applications. His article also includes a comprehensive set of references covering both material and applications.

☐ **Group activity.** Studies show *middle* managers spend one-third to one-half of their time at group activities. Top mangers spend about 60%. American managers generally have a negative attitude toward these activities, regarding them as wearisome tasks imposed by others. The Japanese do a better job at meetings because, instead of feeling uncomfortable or embarrased at group activity, they regard it as a necessary, affirmative part of their function.

The Art of Japanese Management: Applications for American Executives by Richard Tanner Pascale. Warner Books, 666 Fifth Ave., New York, 10103, $3.95

# MICROWAVE DIELECTRIC RESONATORS



*by S. Jerry Fiedziuszko*

**Introduction**

Guided electromagnetic waves propagation in dielectric media received a lot of attention in the early days of microwaves. Surprisingly, substantial effort in this area predates 1920 and includes well known people such as Rayleigh, Sommerfeld and Debye. An excellent historical overview of these efforts, related to the discovery of waveguide, is presented in a Special Centennial Issue of IEEE MTT Transactions [1]. The term "dielectric resonator" first appeared in 1939 when R.D. Richtmyer of Stanford University showed that unmetalized dielectric objects (sphere and toroid) can function as microwave resonators [2]. However, in those troubled times his theoretical work failed to generate significant interest, and practically nothing happened in this area for more than 25 years. There was only a small interruption of this hiatus. It was a paper by Schlicke in 1953 [3] reporting on super high dielectric constant materials (~1000 or more). In the early sixties, researchers from Columbia University, Okaya and Barash, sort of rediscovered dielectric resonators during their work on high dielectric materials (rutile), paramagnetic resonance and masers. Their papers [4,5] provided the first analysis of modes and resonator design. Nevertheless, the dielectric resonator was still far from practical applications. Materials such as rutile exhibited terrible temperature stability (~1000 ppm/degree C), causing correspondingly large resonant frequency changes. For this reason, high Q element waveguide resonators were not used. In the mid-sixties, S. Cohn and his co-workers at Rantec Corporation did the first extensive theoretical and experimental evaluation of the dielectric resonator. The rutile ceramics were used for experiments that had isotropic dielectric constant in the order of 100. Again, poor temperature stability prevented development of components for practical reasons. A real breakthrough in ceramic technology occurred in the early seventies when the first temperature stable, low loss, Barium Tetratitanate ceramics were developed by Raytheon [7]. Later, a modified Barium Tetratitanate with improved performance was reported by Bell Labs [8]. All these positive results led to the actual implementation of dielectric resonators as microwave components. However, the materials were scarce in supply and not available commercially. The next major break through

came from Japan when Murata Mfg. Co produced (Zr-Sn) $TiO_4$ ceramics [9]. They offered adjustable compositions so that the temperature coefficient could be varied between +10 and -12 ppm/degree C. These devices became commercially available at a very reasonable price. After this, the theoretical work and utilization of dielectric resonators expanded very rapidly. To date at least 150 papers covering various aspects of dielectric resonators have appeared, and this number is growing very rapidly.

**Microwave Dielectric Resonator**

***What is it?*** A dielectric resonator is simply a piece of high dielectric constant ceramics usually in the shape of a disc or parallelpiped which functions as a miniature microwave resonator (Figure 1).

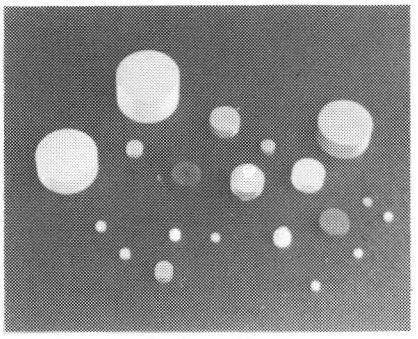


Fig. 1 Dielectric Resonators (1GHz to 12 GHz).

***How does it work?*** The ceramic element functions as a resonator due to the internal reflections of electromagnetic waves at the high dielectric constant material/air boundary. This results in confinement of energy within and in the vicinity of the ceramic material which therefore forms a resonant structure.

***Why use it?*** Dielectric resonators can replace traditional waveguide cavity resonators in most applications, especially in MIC structures. The resonator is small, lightweight, high Q, temperature stable, low cost and easy to use. A typical Q is shown in Figure 2.

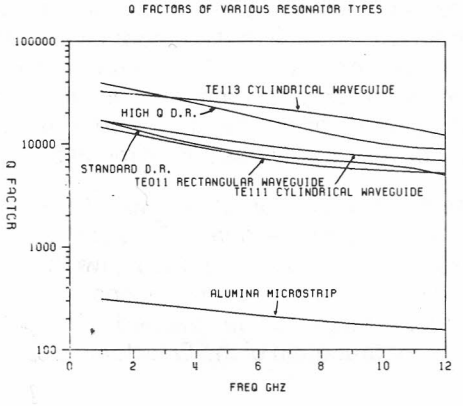



Fig. 2 Quality (Q) Factor of Various Microwave Resonator Types (copper waveguide - 60 to 70% of theoretical Q is assumed).

**Theory of Operation**

As in a conventional metal wall cavity, an infinite number of modes can exist in a dielectric resonator. To a first approximation, a dielectric resonator can be explained as a hypothetical magnetic wall cavity which is the dual case of a metal (electric) wall cavity. The magnetic wall concept (on which the normal component of the electric field and the tangential component of a magnetic field vanish at the boundary) is well known and widely used as a theoretical tool in electromagnetic field theory. In a very crude approximation, the air/high dielectric constant material interface can be modeled as such a magnetic wall (open circuit). Hence, the field distribution and resonant frequencies for such a resonator can be calculated. To improve this model and take into consideration that in actuality some of the field leaks out of the resonator and eventually decays exponentially in its vicinity (this is described by a mode subscript $\delta$), the magnetic wall model of the dielectric resonator was gradually modified. At first two lateral magnetic walls of the resonator were removed and a magnetic wall waveguide below cut-off model was introduced [5,6,10]. This gave a frequency accuracy for the $TE_{01\delta}$ mode of about 6%. Figure 3 shows

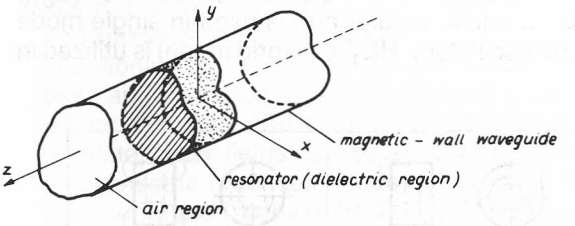



Fig. 3 Magnetic Wall Waveguide Below Cut-off Model of a Dielectric Resonator.

the **magnetic** wall waveguide below cut off. Later, the circular wall was also removed (dielectric waveguide model) and the frequency accuracy was improved to 1-2% [11,12]. In an actual resonator configuration, usually some sort of metal-wall cavity or housing is necessary to prevent radiation and degradation of resonator Q. This is illustrated in Figure 4. Taking this into

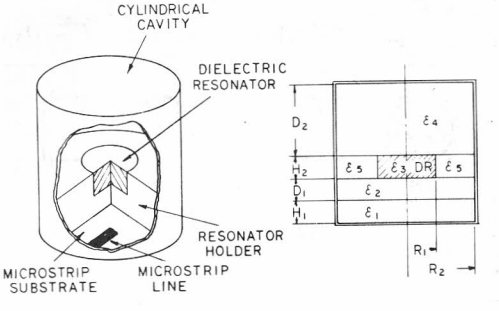



Fig. 4 Practical Configuration of a Dielectric Resonator and Corresponding Theoretical Model (Bonnetti et al [13]).

consideration, the model of the dielectric resonator was modified, and using field expansion, very accurate formulas for resonant frequency and electromagnetic field distribution were obtained. In advanced models, additional factors like dielectric supports, tuning plate, and microstrip substrate, can be also taken into account. The resonant frequency of the dielectric resonator can be calculated with much better than 1% accuracy for mode $TE_{01\delta}$ [13].

The most commonly used mode in a dielectric resonator is the $TE_{01}$ (cylindrical resonator). This particular mode for certain Diameter/Length (D/L) ratios has the lowest resonant frequency, and therefore is classified as the fundamental mode. In general, mode nomenclature in a dielectric resonator is not as well defined as for a metal cavity (TE and TM modes). This matter is quite confusing as is the case of dielectric waveguide. Almost every author has his own designation [14,15,16,21]. In the authors opinion, the mode designation proposed by Y. Kobayashi [14] appears to be the most promising and should be adapted as a standard. Some of the modes and their field distributions are presented in Fig. 5.

As far as applications are concerned, the $TE_{01\delta}$ mode is the most popular and is used in single mode filters and oscillators. $HE_{11\delta}$ (hybrid mode) is utilized in high performance, dual mode filters, directional filters and oscillators. The use of TM modes has been proposed for cavity combiners and filters. Also, low frequency filters (800 MHz) for cellular telephones were designed using the triple mode $TM_{010\delta}$ [17].

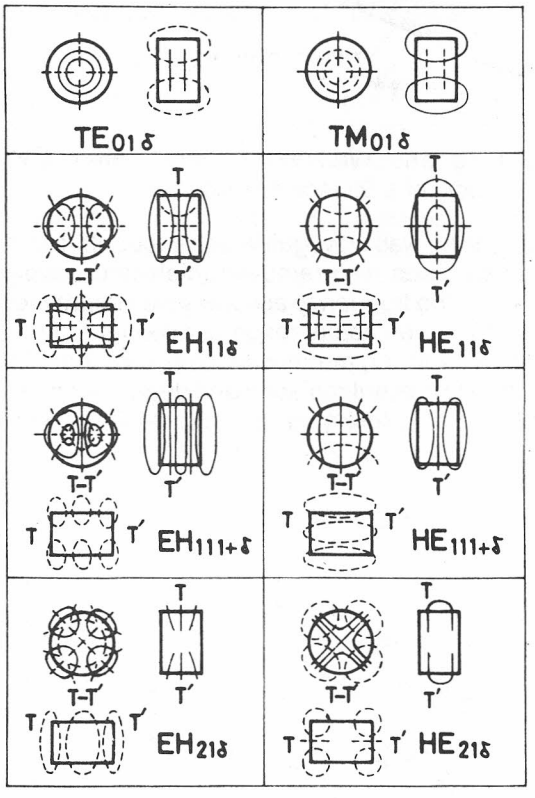



Fig. 5 Modes in a Dielectric Resonator (Kobayashi et al [14]).

**Coupling to Microwave Structures**

One advantage of dielectric resonators is the ease with which these devices couple to common transmission lines such as waveguides and microstrip. A typical dielectric resonator in the $TE_{01\delta}$ mode can be transversely inserted into a rectangular waveguide. It couples very strongly to the magnetic field, and acts as a very simple bandstop filter. Figure 6 illustrates the magnetic

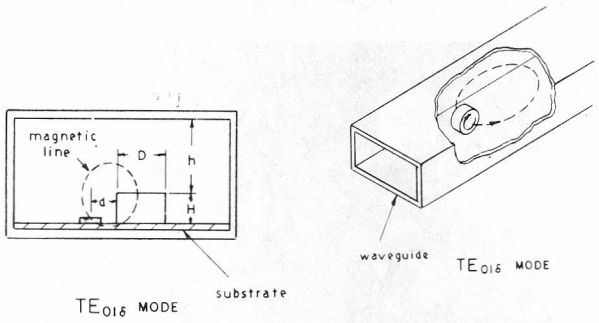



Fig. 6 Magnetic Field Coupling of a Dielectric resonator to a microstrip line and waveguide.

field coupling into microstrip. Coupling to a magnetic field in the waveguide can be adjusted by either rotating the resonator or moving a resonator toward the side of the waveguide. In microstrip line applications, a dielectric $TE_{01\delta}$ resonator couples magnetically and forms a bandstop filter. This is shown in Figure 6B. The coupling can be easily adjusted by either moving the resonator away (or toward center) from the microstrip or by lifting the resonator on a special support above the microstrip. The resonant frequency of a dielectric resonator in this very practical case can be calculated using an equation derived by Atia and Bonetti [13]. The resonant frequency in this topology can be adjusted to a higher frequency with a metal screw or plate located above the resonator and perturbing the magnetic field, or down in frequency, by lifting the resonator (moving it away from the ground plane). A typical range is in the order of 10%. However, extra care must be taken not to degrade the Q factor or temperature performance of the resonator by the closely positioned metal plate.

An interesting modification of the dielectric resonator is the so called double resonator. This configuration is shown in Figure 7. In this configuration, two halves of the ceramic disc or plate act as one resonator. A much wider linear tuning range can be obtained in this configuration without degradation of the Q factor [18,19].

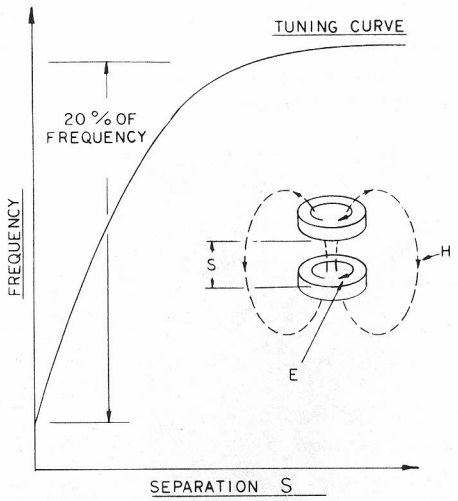



Fig. 7 Double Dielectric Resonator Configuration and Tuning Curve Showing 20% Tuning Range.

## Ceramic Materials

The major problem with previously available high Q materials such as rutile or rutile ceramics, was the poor temperature stability of dielectric constant and the resulting instability of the resonant frequency of the dielectric resonators. However, newly developed high Q ceramics have excellent temperature stability and an almost zero temperature coefficient is possible. The most popular materials are composed of a few basic, high Q, compounds capable of providing negative and positive temperature coefficients. By adjusting proportions of the compounds and allowing for the linear expansion of the ceramic, perfect temperature compensation is possible. Basic properties of high quality ceramics developed for dielectric resonator applications are presented below: [22-26].

Table 1 Properties of Typical Dielectric Resonator Materials

| Material composition | Manufacturer | $\varepsilon$ | loss tan. @ 4 GHz | temp.coeff. ppm/degree C |
|---|---|---|---|---|
| $BaTi_4O_9$ | Raytheon, Transtech | 38 | .0001 | +4 |
| $Ba_2Ti_9O_{20}$ | Bell Labs. | 40 | .0001 | +2 |
| $(Zr\text{-}Sn)TiO_4$ | Murata Thomson CSF Siemens Transtech NTK | 38 | .0001 | -4 to +10 adj. |
| $Ba(Zn_{1/3}Nb_{2/3})O_2$ - $Ba(Zn_{1/3}Ta_{2/3})O_2$ | Panasonic Murata | ~30 | .00004 | 0 to +10 adj. |

## Applications

The miniaturization of microwave components began with the introduction of microwave integrated circuits (MIC) and general advances in semiconductor technology, especially gallium arsenide. MIC components have become very common and presently monolithic circuits are being developed for many applications. However, the MIC structure has suffered from a lack of high Q miniature elements, which are required to construct high performance, narrow band filters, and highly stable, fundamental frequency oscillators. Expensive and bulky coaxial and waveguide resonators made out of temperature stable materials such as invar or graphite composites were the only solution in the past (Fig 2). With the dielectric resonator described above, a very economical alternative, which also satisfies very stringent performance requirements, was introduced.

## Filters

Simultaneously with advances in dielectric resonator technology, significant advances were made in microwave filter technology. More sophisticated, high performance designs (such as elliptic function filters) are now fairly common. Application of dielectric resonators in high quality filters is most evident in bandpass and bandstop filters. There are some applications in directional filters and group delay equalizers, but bandpass and bandstop applications using dielectric resonators dominate the filter field. The bandpass and bandstop filter fields can be subdivided according to the dielectric resonator mode being used. The most commonly used mode is the $TE_{01\delta}$. The $HE_{11\delta}$ (degenerate) hybrid mode finds applications in sophisticated elliptic function filters and high frequency oscillators. This particular mode offers the advantage of smaller volume and weight (approximately 1/2) when compared to a single mode device. This is possible since each resonator resonates in two orthogonal, independent modes.

## Single Mode Bandpass Filters

The basic bandpass filter topology element generally can be described as a section of an evanescent-mode waveguide (waveguide below cut-off) in which the dielectric resonators are housed. This particular configuration was originally proposed by Okaya and Barash [5] and later expanded by Cohn [5] and Harrison [27]. The orientation of dielectric resonators can be either transverse or coaxial. The transverse configuration yields a larger filter, but is presently preferred in practical designs because dielectric resonators in transverse orientation can be more conveniently tuned with screws concentric with the resonators. Typical configurations of such a filter are presented in Figure 8. Actual performance of one of the filters is shown in Figure 9. This particular design suffers from spurious responses on the high frequency side of the filter and suppressing techniques for these frequencies are necessary. The situation is worse when a microstrip transmission line is used to couple between the resonators.

The equivalent Q-factor of the filter is degraded and mounting of the dielectric resonator on special supports is usually necessary. Also, extra care must be taken to select proper dimensions of the dielectric resonator (e.g. D/L ratio) to place spurious modes as far as possible from the operating frequency. Sufficient spacing from metal walls of the housing is also important, since close proximity of conductive walls degrades the high intrinsic Q of the dielectric resonator.

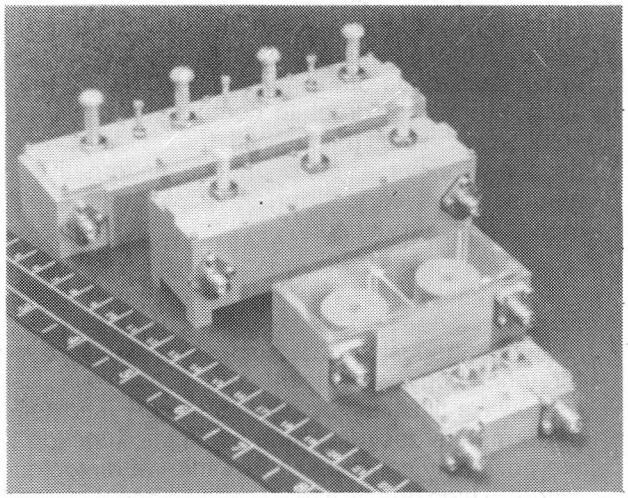


Fig. 8 Single Mode Dielectric Resonator Filters (2.8 GHz and 5.6 GHz).

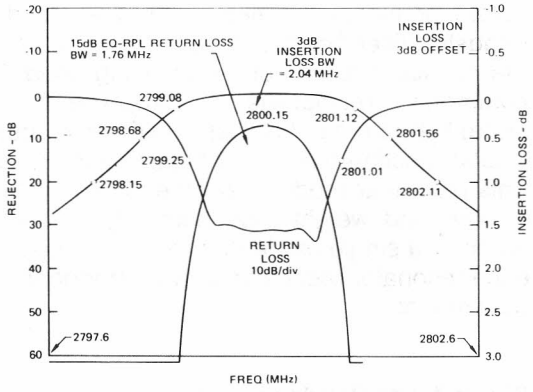



Fig. 9 Typical Performance of a Four-pole, Single Mode Dielectric Resonator Filter Showing Insertion Loss Corresponding to Q Factor of 9000.

**Bandstop Filters**

A very special bandstop filter can be realized just by placing a dielectric resonator in a propagating waveguide or in the vicinity of a microstrip line. However, such simple configurations have poor performance, since a strongly coupled dielectric resonator usually degrades out of band performance of the filter, especially if more than one resonator is being used. One possible improvement is a configuration proposed by Ren which provides isolation for individual dielectric resonators and reduces their perturbation of the waveguide fields [28]. This approach results in a good filter response for the stopband as well as the passband. A typical filter which uses this design is presented in Figure 10. In this particular filter, designed for satellite applications, Space Shuttle tile material was used to mount resonators with minimum loss in small evanescent mode cavities. This filter exhibited excellent electrical performance and also survived without degradation, high levels of vibration and extensive temperature cycling in vacuum [29].

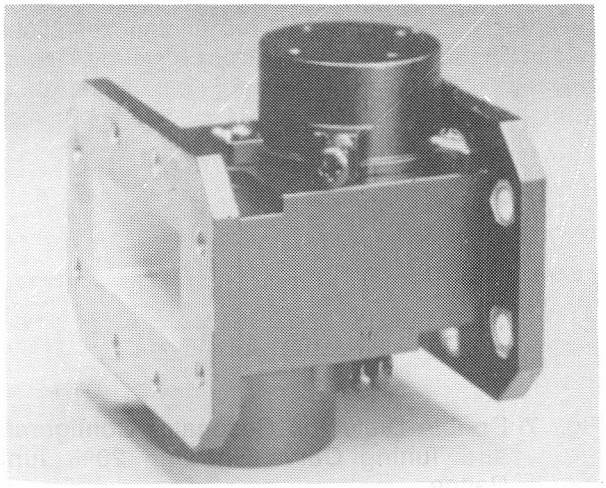


Fig. 10 Space Qualified Dielectric Resonator Bandstop Filter.

**Dual Mode Filters**

After reviewing literature in the dielectric resonator area, it is obvious that most attention has been directed toward analysis and applications of the fundamental $TE_{01\delta}$ mode. Higher order modes and the $HE_{11\delta}$ mode, which for certain ratios of diameter/length has a lower resonant frequency than that of the $TE_{01\delta}$ mode, are considered as spurious modes and hard to eliminate. One notable exception is work by S.B. Cohn, who suggested the use of the $HE_{11\delta}$ mode in directional filters. Even in the case of a radially symmetrical mode like $TE_{01\delta}$, which has only 3 components of the electromagnetic field, rigorous analysis is still a problem, and various simplifying assumptions are required. The situation is much more complex in the case of higher modes, which are in general hybrid (with two resonant frequencies), are usually degenerate and have all six components of the electromagnetic field. A typical filter configuration utilizing the $HE_{11}$ mode (in-line) is presented in Figure 11 [21]. Coupling between modes within a single cavity is achieved via a mode coupling screw with an angular location of 45 degrees with respect to orthogonal tuning screws. Intercavity coupling is provided by selective polarization discriminative coupling slots. This arrangement is similar to that presently used in metal-cavity filters. The design is identical and the standard filter synthesis method can be used. Dielectric resonators are mounted axially in the center of each evanescent, circular cavity. A low-loss stable mounting is required to assure good electrical and tem-

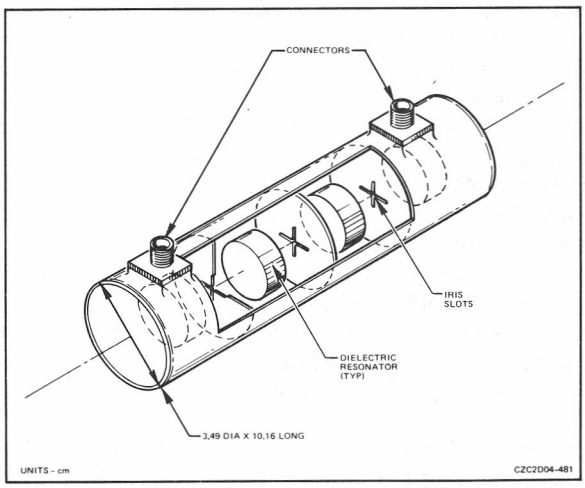



Fig. 11 Dual Mode Bandpass Filter Configuration.

perature performance. Size comparison between traditional cavity filters and a dielectric resonator filter is shown in Figure 12. Weight reduction by a factor of five and volume reduction by a factor of >20 can be achieved. Spurious response performance of the 8-pole filters is very similar to the $TE_{111}$ mode cavity filter. It was found that selection of diameter/length ratios >2 yields optimum spacing of spurious responses. The $TE_{01}$ mode is not excited because of the axial orientation of the resonator in the center of a circular waveguide.

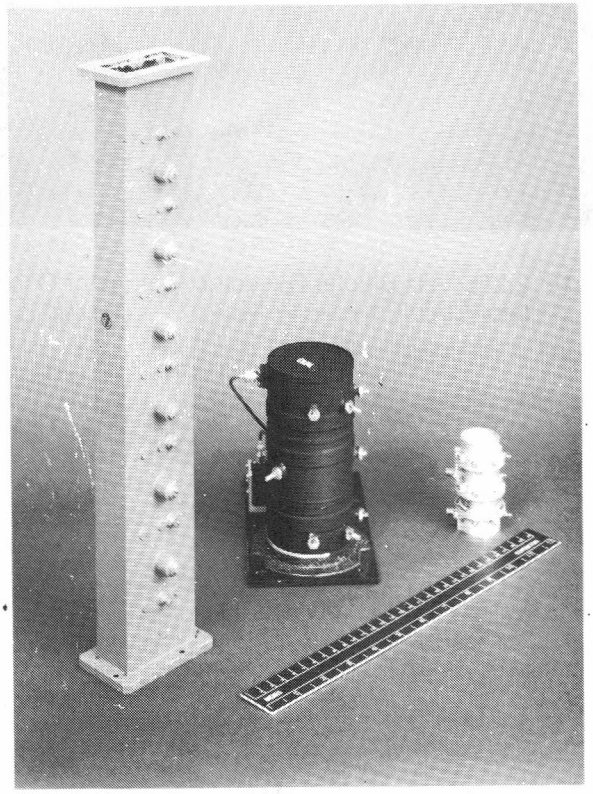


Fig. 12 The Evolution of High Performance Bandpass Filters (4 GHz) Single Mode Waveguide Filter (left) - Dual Mode Cavity Filter (center) - and Dual Mode Dielectric Resonator Filter (right).

One of the important factors in evaluation of a filter design, in addition to its electrical performance, is its temperature stability. Since most of the electromagnetic field of a dielectric resonator is contained in the high dielectric constant material forming the resonator, temperature properties of the filter are basically determined by properties of the ceramics. Typical temperature performance of the filters is in the order of + – 1ppm/degree C with almost perfect temperature compensation possible [30].

**Diode Oscillators**

Dielectric resonators have been used with Gunn diode oscillators to reduce frequency variations due to temperature or bias changes, and to lower oscillator phase noise. A typical configuration of such an oscillator is shown in Figure 13. Stabilities in the order of

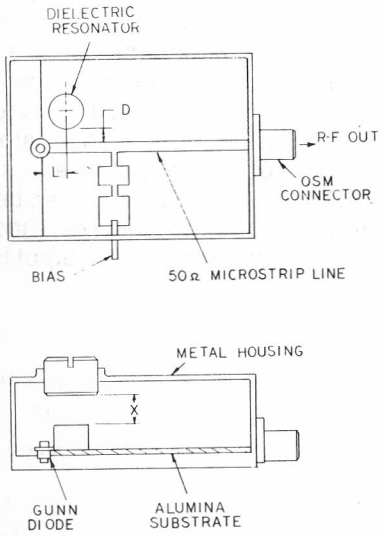



Fig. 13 Gunn Diode Oscillator Stabilized by a Dielectric Resonator (Makino [31]).

0.5ppm/degree C were obtained in such a configuration at 11.43 GHz (Makino [31]). Gunn diode oscillators exhibit lower phase noise at higher frequencies when compared to FET oscillators. However, their performance is inferior when factors such as efficiency and required bias levels are taken into consideration. An interesting application of dielectric resonators used for stabilization of 4 GHz, high power IMPATT oscillators is presented in [32] (Figure 14). The novel oscillator configuration uses two dielectric resonators. This technique allows independent control of fundamental and harmonic frequencies of the oscillator. In this particular case Barium tetratitanate resonators were used.

**Fet or Bipolar Transistor Oscillators**

FET (or bipolar) oscillators utilizing a dielectric resonator as a stabilizing element are classified as reflection or feedback oscillators (Figure 15). For a reflection oscillator, initial design starts with either unstable device or external feedback (low Q) to obtain negative resistance and reflection gain at the desired frequency. Next, a dielectric resonator is placed approximately

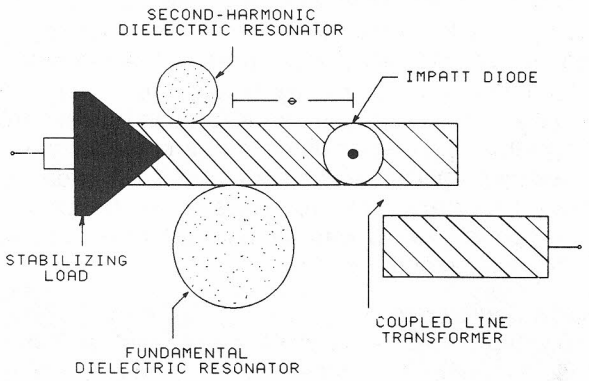



Fig. 14 IMPATT Diode Oscillator Stabilized by a Dielectric Resonator (Dydyk et al [32]).

one-half a wavelength away from the FET or bipolar device. In this configuration, the dielectric resonator acts as a weakly coupled bandstop filter with a very high external Q. Part of the output energy is reflected toward the device and such a self-injected oscillator will generate a signal at the resonant frequency of the dielectric resonator. Typical reflection oscillators exhibit very good phase noise characteristics and stability of approximately 1.5ppm/degree C. However, because of the reflective mode of operation these designs are sensitive to load changes and require an output isolator or buffer amplifier.

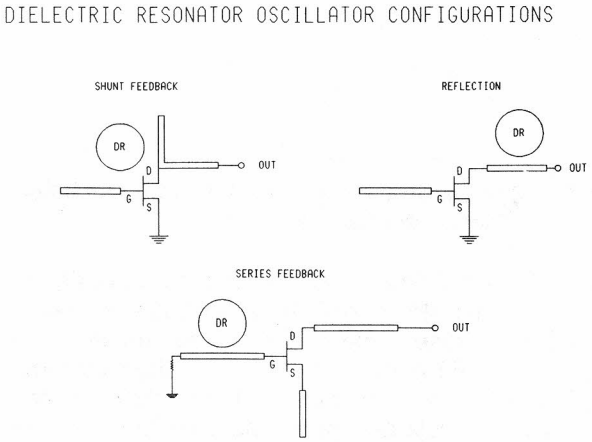



Fig. 15 Basic Configurations of Dielectric Resonator Oscillators.

Feedback oscillators can be divided into two classes: shunt feedback and series feedback. These are illustrated in Figure 15. In these two cases a dielectric resonator actually forms the feedback circuit of the amplifying element, usually a FET or bipolar transistor. In the shunt feedback arrangement the resonator is placed between the output and input of the device (e.g. between gate and source or gate and drain circuits). The conditions for oscillation are met at the resonant frequency of the dielectric resonator. However, in the shunt feedback scheme, the resonator is very strongly coupled to the drain and gate transmission lines. Therefore, the loaded Q of the circuit is quite low and phase noise performance is reduced. Another circuit which yields high stability and low phase noise, is the series feedback oscillator [33]. This circuit consists of a high gain low noise FET or bipolar transistor, a 50 ohm transmission line connected to the FET gate (bipolar-base) (which is terminated with a 50 ohm resistor for out of band stability), a dielectric resonator coupled to the line and located at a specified distance from the gate (base), a shunt reactance connected to the FET source or drain (collector), and matching output impedance. Critical to the performance of this circuit is the placement of the dielectric resonator on the gate port, where it is isolated from the output circuits by the very low drain to gate capacitance inherent in the device. This isolation minimizes interaction between the output and input ports, which allows the resonator to be lightly coupled to the gate, resulting in a very high loaded Q, and therefore minimum phase noise. A photograph of such an oscillator is shown in Figure 16. The phase noise performance, which demonstrates suitability of such oscillators for stringent communication systems, is presented in Figure 17.

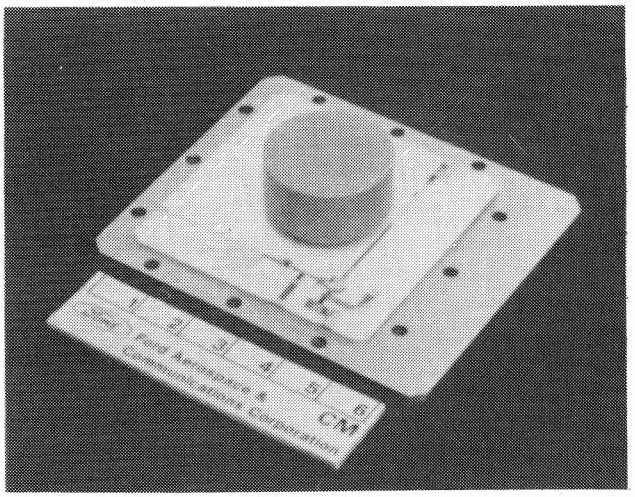


Fig. 16 2.225 GHz Bipolar Dielectric Resonator Oscillator Circuit.

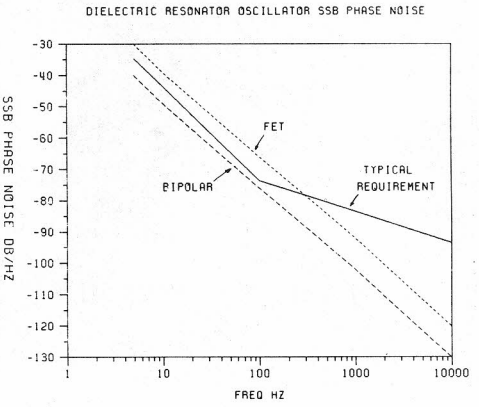



Fig. 17 Phase Noise Performance comparison of 2.225 GHz DRO's (Bipolar versus FET).

## Conclusions and Future Outlook

Applications of dielectric resonators in various microwave components are very cost effective and lead to significant miniaturization, particularly when MIC structure is used. Excellent performance in devices such as filters and oscillators is being achieved. Recently available very high Q materials will extend commercial applications of dielectric resonators to much higher frequencies. Applications as high as 94 GHz are being reported.

Development of higher dielectric constant (~80) materials will have a significant impact on lower frequency microwave devices (1 GHz region). Further material development is needed, mostly in development of dielectric materials with lower dielectric constant. New, low loss plastics and adhesives should be developed to insure that the excellent properties of dielectric resonator ceramics are not degraded, which is usually the case at present.

In conclusion, dielectric resonators are here to stay, and a wide variety of commercial components utilizing these elements are already available. With the advent of new materials and improved circuit techniques, the field of dielectric resonators will continue to develop and will certainly be exciting in the future.


## Acknowledgments

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**S. Jerry FIEDZIUSZKO** is presently a Principal Engineer at Ford Aerospace & Communications Co., Western Development Laboratories, Palo Alto, CA. He has been affiliated with Ford Aerospace since 1979. From 1971 to 1979 he was a Chief Engineer for LDV Electroscience Industries (former Radar Design Co.) in Syracuse N.Y. and a member of Adjunct faculty at Syracuse University. From 1967 to 1970 he was associated with the Institute of Electron Technology, Polish Academy of Sciences, Warsaw, Poland, where he completed all requirements for his Ph.D degree (except oral presentation of the dissertation). He has received his MSEE (with distinction) from Warsaw Technical University, Warsaw, Poland in 1967.

Jerry Fiedziuszko is the author of more than 30 papers, mostly in the dielectric resonator area. He also has several patents in the same field. He is a Senior Member of IEEE.

☐ **New-breed workers** are looking for goals that are different from the ones many companies provide. Research with over 23,000 people found that opportunities were most important—opportunities to do something to increase self-esteem...accomplish something worthwhile...learn something new...develop skills and abilities...have freedom on the job...and do the things one does best. Of the 18 items rated, job security came in eleventh, pay twelfth and fringe benefits sixteenth. *Lesson for top management:* Many traditional incentives are out of line with what today's workers really want. If you adjust incentives properly, employees will be more productive.

*Beating Job Burnout* by Dr. Beverly Potter, Ronin Publishing, Box 1035, Berkeley, CA 94701, $9.95.

# EDUCATION COMMITTEE-HIGHLIGHTS

*by Kris Agarwal*

**Introduction**

1985 has been a year of progress and success for the education committee. MTT-S AdCom has been and continues to be very supportive of the microwave research activities and education of its members as well as their children. As a service organization, with a highly diverse and opinionated membership, it has not been easy to agree on a uniform approach to serve the needs of its membership. But I am glad to report the beginnings of a service with bigger and better things yet to come. MTT-S AdCom has approved the following three awards:

**Educational Grant-in-aid**

For individual members of MTT-Society and non-profit institution. Number of awards and amount shall be based on a proposal submitted to MTT Society. The proposal must relate the proposed activity, benefit and risks to the MTT Society and include a financial justification. Each proposal shall be judged by MTT-S AdCom or a committee designated by MTT-S AdCom. The awards shall be announced by June and presented at the MTT-S International Symposium each year.

**Microwave Fellowships**

For individual graduates wishing to pursue a graduate degree in microwave engineering on a full time basis. Several $5,000 and MTT-S membership awards shall be offered each year. The applicants must have attained high academic levels in engineering or physics from an approved school and demonstrate interest in microwave engineering studies at graduate level. Two letters of recommendations from under-graduate faculty are needed and the candidate would be required to appear for a personal interview with MTT-S AdCom approved evaluation committee.

**MTT-S Merit Scholarships for children**

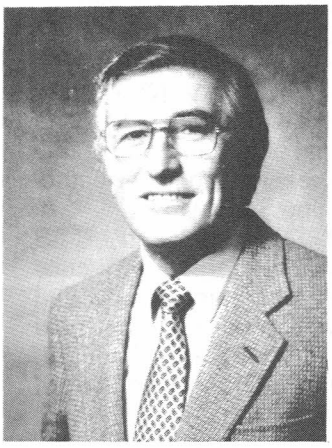
These two merit scholarships are directed to help the talented children of MTT-S members to further their education at undergraduate level (not limited to engineering). The annual award is $1,000 to $2,500 each, renewable for four years. Awards are given to national merit finalists based on PSAT/NMSQT test scores, academic record, leadership and significant extra-curricular activity. The awards are announced by the National Merit Scholarship Foundation each year in the spring based on applications received by the MTT-S Education and Scholarship Committee. For the 1986 school year, the processing of applications received is already underway.

MTT-S Education Committee intends to pursue these and other grant/scholarship activities. Further information on these awards can be obtained by contacting me by mail or phone:

**Krishna K. Agarwal**
**ROCKWELL INTERNATIONAL CORP.**
**CTSD, M/S 402-140**
**P.O. Box 10462**
**Dallas, TX 75207**
**(214) 996-5751**

All three awards are subject to approval and review by the IEEE Executive Committee. I am interested in hearing from you, MTT-S members, about your ideas and suggestions to make the MTT-S education committee truly effective and responsive to the needs of all us members. Before concluding, I would like to express my thanks to all MTT-S AdCom members for the step in the right direction.

# 1985/86 DISTINGUISHED MICROWAVE LECTURER



*by Kenneth L. Carr*

## The Application of Microwave Technology to the Detection and Treatment of Cancer

Since the commencement of my lecture series in September 1985, I have been most gratified by the overwhelming response from the many Sections and Chapters of this organization. As of this writing I have visited 22 cities in the United States and two cities in South America, resulting in approximately 30 lectures. My audiences ranged from 10 individuals to 100, with a total approaching quite close to 1,000 people. All have been most cordial and receptive, with most of the groups (due to the subject matter) including spouses, sisters, daughters, etc.

A planned visit to the United Kingdom in March is in the offing, together with a combined visit to New Zealand, Australia, India, Japan and Taiwan in September 1986. The schedule has become so tight that this latter visit had to be delayed until the fall. In addition, a visit to Spain, France, Italy and West Germany has yet to be firmed up.

Domestically there still remains a very heavy schedule through June of 1986. This will encompass 34 cities, with two of these in Canada — our friends to the North.

While traveling so extensively for this series, I have been warmly received by all Chapter Chairmen. Many invitations have been extended to tour local high technology facilities and view work in progress throughout the country. For an engineer such as I, this is most stimulating and I again thank you for the opportunity.

Kenneth L. Carr
M/A-Com, Inc.,
South Avenue
Burlington, MA 01803
(617) 272-3000

# 1986/87 DISTINGUISHED MICROWAVE LECTURER

*by John H. Bryant*

**BIOGRAPHICAL SKETCH**

John H. Bryant is currently in Adjunct Research Scientist in the Department of Electrical Engineering and Computer Science, The University of Michigan, Ann Arbor. His career in the microwave field got an early start after he received his B.S.E.E., was commissioned a Second Lieutenant in the U.S. Army Signal Corps in 1942, and was sent to England for radar school and operational training. From 1943 to 1945 he served with the American forces in operational radar and communications.

Following graduate work at the University of Illinois, Dr. Bryant worked from 1949 to 1955 at ITT Laboratories in New Jersey developing traveling-wave tubes. From 1955 to 1962 he was with Bendix Research Laboratories in Michigan, working on microwave components and missile guidance systems. In 1962 Dr. Bryant was a founder of Omni Spectra, Inc., and served as its President and Chief Executive Officer. Omni Spectra microwave components and OSM miniature coaxial connectors opened up the upper half (above 10 GHz) of the microwave frequency range to coax and planar circuit construction, and accelerated the move from waveguide to compact, TEM-type designs. After the company became a part of M/A-COM, Inc., in 1980 he served as consultant to that firm until 1985. Dr. Bryant is a Fellow of IEEE and past chairman of MTT-S AdCom (1970) and the S.E. Michigan Section of IEEE (1970). He holds 14 U.S. patents, and is a member of Sigma Xi, Tau Beta Pi, Eta Kappa Nu, and the American Physical Society.

## The First Century of Microwave - 1886 to 1986 A Historical Perspective of Microwave Devices and Their Uses

The first century of microwaves began with the historic experiments of Hertz in 1886 to 1888. It is significant that Hertz used what we now call microwave circuits and techniques. His remarkably thorough

investigations opened up the electromagnetic spectrum between DC and light for scientific and practical uses. His was a step-by-step learning process, alternating between experiments and analytical work.

The presentation will start with a synopsis of major milestones leading up to Maxwell's famous 1864 article predicting electromagnetism, and summarizes activities from that time until Hertz demonstrated the validity of Maxwell's theory in 1887. Hertz's immediate successors before 1900 — more than 20 in number, in at least 9 countries — made major advances in techniques, technology and scaled their apparatus to shorter wave lengths into the millimeter range. Replicas of some of the apparatus will be shown for illustration. A brief account will be given of publications during the period prior to 1900, of people working in the field and how they interacted.

The period following 1900 was relatively slow, but after the advent of CW signal sources, Barkhausen-Kurz tubes (1920) and magnetrons (1928), along with improved technologies including detection, interest in microwaves was revived. Systems interests centered in communications and early radar experiments.

The presentation will conclude with selections from the author's study of historical records and some personal interviews with pioneers of microwave devices and their applications.

John H. Bryant
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Department of Electrical Engineering
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The University of Michigan
Ann Arbor, MI 48109
(313) 663-4618

# 1986/87 DISTINGUISHED MICROWAVE LECTURER

*By Edward C. Niehenke*

**BIOGRAPHICAL SKETCH**

Edward C. Niehenke received his BS (1961) and MS (1965) degrees in electrical engineering from Drexel University, Philadelphia, PA. In 1970 he completed additional course work in electrophysics at the University of Maryland, College Park, Maryland. In 1963, after two years of cryogenic electronics research at Martin Marietta (Baltimore), he joined Westinghouse (Baltimore) where he has been responsible for the development of low noise amplifiers, limiters, oscillators, mixers, and miniature microwave integrated circuits.

His present duties as advisory engineer for Microwave Operations of the Design and Producibility Divisions include the consultation and development of microwave circuitry for radar and ECM with emphasis on low-noise techniques. He holds five patents and has authored numerous papers on microwave circuits.

He lectures on Non-linear Circuit Design (Oscillators and Low Noise Amplifiers) for UCLA Extension and the Continuing Educational Institute and is also on the faculty of the Johns Hopkins University teaching Electricity and Magnetism in the Evening School.

Niehenke is a member of MTT-S Adcom and MTT-S Microwave and Millimeter Wave Integrated Circuits Technical Committee, and is chairman of the 1986 MTT-S International Microwave Symposium, to be held in Baltimore, MD. He is a senior member of the IEEE, and is a registered Professional Engineer in the State of Maryland.

# GaAs—Key to Modern Microwave Technology

Recent advances in microwave technology can be traced to developments in GaAs devices and circuits. GaAs has found its niche for the FET, HEMT, varactor, PIN, IMPATT, and Gunn devices. Many technical breakthroughs and developmental activities using GaAs have surfaced in recent years, which has resulted in the insertion of GaAs in the modern microwave system. The system, whether communication, radar, electronic warfare, missile guidance, or commercial, has benefitted by using GaAs in the areas of reliability, efficiency, performance, speed, size as well as extending the frequency range of the system. GaAs enables smaller and lighter systems to perform many sophisticated microwave processing functions not possible with other technologies.

GaAs will be compared with other materials, and the salient properties of GaAs which benefit the various semiconductor devices will be highlighted. The effect of temperature and radiation will be included. The latest device technology for both discrete devices and monolithic circuits will be reviewed. The recent state-of-the-art design techniques and performance will be presented for many GaAs devices and circuits.

Techniques which are used to achieve broadband, low noise or high power, high efficiency FET amplifiers will be discussed. The FET oscillator discussion will include design synthesis and circuits for highly stable fixed tuned (DRO) and electronically tuned oscillators (VCO, YIG). Various methods to reduce the oscillator 1/f phase noise will be reported. In addition, recent two terminal Gunn and IMPATT oscillator results and circuits will be shown. To conclude the lecture, information regarding phase shifters, attenuators, and efficient, high power multiplication using GaAs will be presented.

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The Distinguished Microwave Lecturer may be scheduled by writing or calling:

Mr. Edward C. Niehenke
Westinghouse Electric Corporation
P.O. Box 746, MS-339
Baltimore, MD 21203
(301) 765-4573

# PROFESSIONAL ACTIVITIES COMMITTEE FOR ENGINEERS (PACE) REPORT

*by R.A. Moore, Representative*

## TECHNICAL ACTIVITIES COUNCIL

How is the IEEE working on issues important to our careers and professional interests? To the Microwave Society, program funding levels and directions related to the microwave industry are important to us. Consider the following: For the past year IEEE played a major role in formulating the National Research Agenda which was sponsored by the National Research Council's Engineering Board. Research priorities were identified as follows:

**Biomedical Engineering Systems**
- biosensors
- medical imaging
- cardiac assist devices
- medical artificial intelligence and information systems
- medical robotics and automation
- rehabilitation engineering
- mechanisms of accident injury and protection
- artificial environments

**Energy Resources and Environment**
- energy delivery
- the need for stable support of research in areas beyond the scope of private enterprises

**Information and Computing Technology**
- information storage systems
- programming environments
- multiprocessor systems
- a critical need for Ph.D. education in computer science, rather than stopping at the bachelor's level

**Manufacturing Systems**
- comparative design analysis
- software, languages and graphics

**Electronic Materials**
- silicon materials
- gallium aresenide
- compound semiconductor heterostructures
- magnetic materials

Do you agree with the above research priorities? If you do, your IEEE has well represented you. If not, you should be trying to influence the appropriate USAB policy committee. With these priorities for the National Research Agenda, the above recommendations will be significant in the over-all program planning and funding.

Besides the major task force activities such as the above, the Technical Activities Council (TAC) committees regularly provide testimony for Congressional committees and executive branch planning groups. While reviewing a recent report of TAC committees, I found 21 examples of congressional testimony, 8 letters and positions provided in writing, and 16 positions reported under investigation or in various stages of preparation. Two of the position papers were "Human Exposure to Microwaves and Other Radio Frequency Electromagnetic Fields" and "Absence of Hazardous Levels of Nonionizing Radiation from Video Display Terminals." Two position papers under consideration are, "Health and Safety of Extremely-Low-Frequency EM Radiation" and "Radio Frequency Radiation and Carcinogenesis." If unchecked, the potential for misinformation about our profession is great. Areas of testimony, position papers, written briefs and positions in planning and preparation included subjects of communications security and personal data privacy, a supercomputer software laboratory, direct broadcast satellite, need for availability of translations of Japanese technical journals, acid rain, effect of microwave radiation on land use planning, effect of electric power fields on land use planning, NASA budget, NASA Space Station and the list continues.

Of particular interest to microwave engineers are the findings and recommendations of the Task Force on Defense Electronic Materials. Their concern is the apparent shifting of the center of gravity for world-class materials preparation off-shore. High foreign investment in both personnel and equipment is negatively affecting the U.S. technology and production base in crystal growth, layered (epitaxial) growth and, perhaps most frightening, in materials-sensitive silicon IC processing. Their recommendation was the establishment of a five-year Industry-University Centers-of-Excellence package in Defense Electronic Materials. Four such centers were recommended:
- A Center for Advanced Bulk Crystal Growth -
- A Center for Artificially Structured Layered Growth

- A Center for Classified Defense Materials Research -
- A Center for Study of Material Influences on Integrated Circuit Processing -

The suggested budget for these centers would be $240M for the first five years of operation or an average of $12M/center/year.

One of the largest problems voiced by TAC committees, is that they lack the people resources to do their best job. When USAB first began as the professional/career arm of the IEEE, we had to seek invitations to testify. Now we receive many more invitations and requests for our type expertise than can be filled. This is unfortunate since these are missed opportunities to serve our profession. TAC committees request personnel of the Societies each year. Characteristically these requests are filled so slowly that most committees work only one-half year and, in fact, most committees are way under staffed.

TAC is composed of joint TAB USAB committees which prepare positions and provide testimony on technical issues for related public policy questions. Much of their activity centers on materials for and testimony before congressional committees. The work is done in terms of the following committees and task forces:

- Communications and Information Police Committee (includes Scientific Supercomputer Subcommittee)
- Environmental Quality Committee
- Committee on Man and Radiation (COMAR)
- Aerospace R&D Committee
- Engineering R&D Committee
- Defense R&D Committee
- IEEE Energy Committee
- Health Care Engineering Policy Committee
- Task Force on Productivity and Innovation
- Task Force on SDI

The IEEE office identifies four of the above committees on which we have representation:

- Communications and Information Policy Committee - Ferdo Ivanek
- Environmental Quality Committee - John M. Osepchuk
- Committee on Man and Radiation - John M. Osepchuk
- IEEE Energy Committee - John Tancredi

If you would be interested in serving on one of these TAC committees, you should notify the Society president or myself. Also if you have interest in communicating with any of the TAC committees on any issues and need help in identifying the contact, I would be most happy to assist. My phone number is (301) 765-4027 and my address is Westinghouse DEC, P.O. Box 746, MS 335, Baltimore, MD 21203. Let me hear from you.

# DIVISION 4
# ELECTROMAGNETICS AND RADIATION
# KEY DEVELOPMENTS OF THE LAST HUNDRED YEARS

*by Emerson W. Pugh, 1984 Director*

In commemoration of the IEEE Centennial, I met with presidents of the IEEE societies in the Division of Electromagnetics and Radiation, to discuss the technological advances of the past hundred years that have most influenced the work of our members. Our "meeting" was held by phone, air mail, and electronic mail, none of which existed one hundred years earlier.

Clark E. Johnson, Jr., 1984 president of the Magnetics Society, noted that his society probably represents the oldest of our technologies, with the use of magnetic compasses for navigation dating back before 1100 AD. By the time the American Institution of Electrical Engineers was organized in 1884, two major applications of magnetism and magnetic materials had already been created: the dynamo and the electromagnet. During the last century, significant advances in soft magnetic materials have made power distribution and generation more economical, and permitted development of higher-efficiency, low-cost motors. The development and commercialization of nonmetallic magnetic materials such as ferrites have sparked the way for exceptional improvements in telephoning, communications, and radar — not to mention ferrite cores that provided the first reliable, high-speed memories for electronic computers beginning in the mid-1950s. Yet magnetics have often been considered to be an arcane and somewhat uninteresting endeavor. Nothing could be further from the truth.

The atomic origins of magnetism itself are still only poorly understood; and in so far as a dynamic growth industry is concerned, magnetic recording media manufacturing has been growing at 30 percent per year over the last three decades. Recent magnetic developments, such as amorphous films, will undoubtedly touch our daily lives in as important ways as the magnetics of old.

Allan W. Love, 1984 president of the Antennas and Propagation Society, notes that in the 36 years of its existence, the Antennas and Propagation Society and its members have contributed to many astonishing

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# Book Review "Millimeter Wave Engineering and Applications"

*by P. Bhartia and I.J. Bahl*
John Wiley & Sons, 1984

This book treats recent developments in millimeter-wave technology. It consists of ten chapters. After a brief introduction in Chapter 1 on the characteristics and applications of millimeter-wave in contrast to microwaves and optics, the authors describe millimeter-wave sources in Chapters 2 and 3. Tubes are treated in Chapter 2 and solid state sources in Chapter 3. In addition to devices familiar to many engineers such as TWT, BWO, Klystron, Magnetron, IMPATT and Gunn, more exotic and futuristic but promising devices are included. An example of the latter is TUNNETT diodes. Circuit techniques for tuning and power combining are also included. The latter is particularly important as the frequency is increased.

Brief discussions are given on the three-terminal device. Obviously, when this book was in preparation, successful use of MESFET's at millimeter-wave frequencies had just started. Recently, the importance of MESFET has increased at least to 60 GHz. In addition, new promising devices based on III-V compounds such as HEMT have emerged. I hope that more comprehensive treatment of these topics will be included in a future revision of the volume (although brief descriptions appear in Chapter 8).

Propagation of millimeter-waves in free space is treated in Chapter 4. Several factors concerning propagation are included. This chapter is useful for millimeter-wave system consideration.

Chapters 5 and 6 deal with guided propagation of millimeter-waves. Conventional waveguides are treated in Chapter 5. Chapter 6 is a very comprehensive treatment of what the authors call integrated dielectric lines. Microstrip lines, finlines and other printed transmission lines are discussed first. Characteristics of these lines are illustrated. A brief explanation of analytical/numerical methods and closed-form design equations are included. Next, various dielectric waveguides as well as H-guides and groove guides are discussed. However, one of the more promising structures, the nonradiative dielectric waveguide (NRD) is not discussed. Once again, this topic should be the target for future revision.

Chapter 7 is on the passive components. In addition to review of traditional waveguide structures, a number of designs are described for integrated circuit structures. Chapter 8 treats solid state circuits. Some of those included are detectors, mixers, amplifiers, multipliers, switches and phase shifters.

Chapter 9 is on the millimeter-wave antenna and is the largest chapter in the book. Not only practical antennas such as dishes and lens but more research oriented topics such as leaky wave antennas made of dielectric waveguides are included.

Chapter 10 contains examples of millimeter-wave systems including radar, communication and radiometry.

An appendix and a problem set are included at the end of the book. In contrast to the text written with more practical motif, the appendix is very theoretical.

Due to the extent of the topics included in a fair size volume, some items are not explained extensively enough. However, a very comprehensive reference list is included at the end of each chapter for further information.

I had the impression that this book treats passive structures (transmission lines, passive components, antennas) more extensively than active structures. This may be due to the technical background of the authors, or to the fact that more coherent treatment is possible to the passive structures.

According to the preface, this book has been developed from the lectures in a graduate level course at University of Ottawa.

From my experience this book should also be useful as a desk-side reference for graduate students and working engineers. Since a large number of recent publications are referenced, engineers can use this book as a starting point for locating more comprehensive and/or extensive information.

This book is a useful addition to literature for the microwave community.

Reviewed by T. Itoh
University of Texas

(continued from page 28)

developments. Prominent among these are the sophisticated ground and satellite antennas with their multiple and contoured beam capabilities for communications, the antennas of NASA's deep space tracking network that facilitate the exploration of our solar system by space probes, and the exquisitely sensitive antennas used in radio astronomy to probe the vast reaches of the universe at distances well beyond the capabilities of their optical counterparts. In the area of remote sensing we find many examples of satellites carrying both active and passive remote sensing systems using antennas to gather the unimaginably weak signals emitted or reflected by the land and sea surfaces. A prodigious amount of theoretical and experimental effort has gone into studies of electromagnetic wave propagation in all kinds of media, homogeneous and nonhomogeneous, isotropic and nonisotropic. Electromagnetic waves are now used extensively to delineate otherwise inaccessible sub-surface features in the earth's crust and to locate discontinuities which can point to oil, gas and mineral deposits, and they are increasingly being used in medical imaging techniques and for noninvasive diagnosis and treatment.

H. George Oltman, 1984 president of the Microwave Theory and Techniques Society, observed that micro-

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wave devices and components are generally not end-products; they are used as components by other industries to make useful systems for the benefit of mankind. An obvious example is radar in all of its forms: weather avoidance, commercial and military, airborne, satellite geophysical, automotive and on and on. Microwave heating has come closest to being a microwave end product. Two major thrusts have made possible the recent expansion in communications services: point-to-point microwave repeaters and satellite stations. Now we are beginning to see the effects of another technology, fiber optics, that promises even lower communication costs. Members of the Microwave Theory and Techniques Society have, over the last five decades, developed sophisticated and versatile design tools. Not only have these tools extended the variety, the speed, and the quality of microwave components, but they have been modified and used by workers in other fields.

Eugene D. Knowles, 1984 president of the Electromagnetic Compatibility Society considers Marconi to be the first EMC engineer. Four years after Marconi successfully demonstrated radio communication, he filed patent No. 7777, which permitted more than one station to operate without interference. Since then, technology and systems have grown and become more sophisticated. Armstrong's superheterodyne permitted more devices in a finite spectrum, and the advent of radar and pulse equipment in the 1940s and 1950s expanded the use of the spectrum and greatly increased the need for electromagnetic compatibility. The field was technically active but professionally unorganized until 1957 when the IRE granted a charter to the new Professional Group on Radio Interference; the group later became an IEEE Society. In the IEEE Centennial year the membership passed 2500 and the first International Symposium was held in Tokyo, Japan. Now, 85 years after patent 7777, electromagnetic compatibility has become an internationally recognized discipline.

John A. Martin, 1985 president of the Nuclear and Plasma Sciences Society recalls that this society was formed as the professional group on Nuclear Science in 1949, two years after a study committee was commissioned to determine the proper role of the IRE in this field. At the beginning of this century of progress, the scientific discoveries that underpin the nuclear plasma sciences had not been made: the electron was discovered in 1896; the neutron was identified in 1932; nuclear fission was not understood until 1939. The development of the nuclear energy sources and applications and basic research in nuclear and particle physics have driven the growth of the nuclear sciences. The plasma sciences have been stimulated by a broad spectrum of important applications of plasma devices and the possibility of limitless power through controlled thermo-nuclear fusion. The challenges seem limitless. Perhaps in no field of IEEE are there greater uncertainties and opportunities as we enter the second century of the IEEE.

# CHAPTER RECORDS

*by Ted Nelson*

As I prepared the latest update of the MTT-S Chapter Chairman's Records for inclusion in this issue of the Newsletter, and also for the Membership Directory, I was happy to note that MTT-S now has 46 active Chapters worldwide. This compares with 43 last year at this time. Two are new Chapters, San Fernando Valley and Spain. The third is a reactivated Chapter, Tucson. Congratulations are due not only to the officers and members of these three Chapters, but to officers and members of all Chapters, for their work and effort in supporting MTT-S on a local and International level. It is they who are in a great part responsible for disseminating the latest technology within the microwave field, and also for promoting the contributions of microwave engineers in other areas of science, such as medicine. This is done through the numerous Chapter meetings, the National Lecture Series, and the MTT-S International Symposium, all of which would not be possible without the existance and support of the Local Chapters.

This Newsletter column concludes my two year term in charge of Chapter Records on the MTT-S Membership Services Committee. The most enjoyable part of this effort was meeting and talking with many Chapter officers and members, especially at the Chapter Chairmen's Dinners and Meetings.

Thank you all for your help and cooperation.

**ALBUQUERQUE (MTT/AP/EMC)**
ADCOM Liaison: P.T. Greiling

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# PROFESSOR H.M. BARLOW, FRS MICROWAVE CAREER AWARD

FROM time to time IEEE Societies acknowledge those engineers who have contributed a lifetime of outstanding service to their subject — Professor H. M. Barlow is the well-merited recipient of the MTT Society's 1984 Career Award.

As Sub-Lieutenant Barlow he was commissioned in the Royal Naval Volunteer Reserve at the age of 17. Here he worked on the then new science of wireless communication, investigating the possibility that radio signals could be received in submarines at a depth of 30ft. The transmitter used a 100kW Poulsen arc oscillator operating at a frequency of 15kHz; under favorable circumstances it had a range of some 100 miles.

After only two years post-war study at University College he was awarded a First Class Honours Degree and the Diploma of the City and Guilds Institute, of which body he is now a Fellow. A short period in his father's electrical contracting company sharpened his preference for an academic life and he accepted a post as lecturer on the Design of Electrical Machines, in the department of Sir Ambrose Fleming - salary £300 per year. That decision he has never regretted. The "electronic valves" with which he was then experimenting were hand made and used substantial electrically driven vacuum pumps - how many transistors do we now use to the square millimeter?

The octogenarian Professor Barlow still remembers well conversations with Guglielmo Marconi; he has lost none of his stimulating mental capacity and is still publishing research results, but now on Optic Fibres. It was a very great pleasure to meet and talk to someone who was there when it all began, and who brings vividly to life those whose names are to most of us no more than words in a book.

## PERSONAL ANSWERS

**How can a neophyte make a good pick from a big wine list without embarrassing himself or his dinner guests?**

The best way to choose among unknown wines is to pick one that has a familiar aspect (type of grape, region, producer) that you like. If you want to try something new, you can ask the captain what he would recommend. (Don't ask the waiter). *Important:* Mention your preferred price range.

*Face-saving alternative:* Choose two or three wines in the general category that you're interested in (dry red or fruity white, for example). Then approach the captain: "I can't decide between these wines. Which do you recommend?" This shows some knowledge of wine on your part, makes use of the captain's expertise and guarantees you and your guests a good bottle of wine.

# SHORT COURSES

A number of organizations are offering short courses this Winter, which will be of interest to some members of the Microwave Theory and Techniques Society. The following selected short courses will be offered by UCLA Extension during February.

**UCLA Extension Courses, Winter of Jan.-Mar. 1986, Los Angeles, CA**

**ECM/ECCM/ESM (Electronic Countermeasures/ Electronic Support Measure Systems) for Radar Systems, Communication Systems, Electro-Optical Systems, and Millimeter-Wave Systems,** Feb. 24-28, 1986, Course No. Engineering 867.48, Fee: $975. Lecturers are David W. Berrie, T. Gordon Hame, Gary L. Henshaw, Joseph F. Hoffmann, Anthony J. Kramer, Julio Lopez, Oscar Lowenschuss, Wesley K. Masenten, Donald M. Stuart, Ray A. Trimmer.

**Fiber Optics: Technology and Applications,** Mar. 10-12, 1986, Course No. Engineering 823.24, Fee: $775. Lecturer: Stewart D. Personick, ScD

**Kalman Filtering,** Mar 10-14, 1986, Course No. Engineering 881.38 Fee $975. Lecturers: Joseph L. LeMay, PhD, William L. Brogan, PhD.

**Integrated Communications, Precision Position Determination and Navigation, and Identification Systems: Principles, Technology, and Operational Aspects,** Mar. 17-21, 1986, Course No. Engineering 867.60, Fee $975. Lecturers: Mohar Ananda, Darlow Botha, Alison K. Brown, Peter C. Camana, George Hume, William M. Hutchinson, James A. Kwett, Robert Rand, Mark A. Sturza.

**Modern Microwave Measurements and Applications,** April 8-11, 1986, Course No. Engineering 881.65, Fee: $995., Lecturers; K. C. Gupta, Edward C. Niehenke, Robert A. Pucel, Franco N. Sechi.

For the above UCLA Extension Course, further information can be obtained from Stephen F. Adam at (415) 968-4900 or 965-4020 or Joseph L. LeMay (213) 316-1665 or Cornelius T. Leondes at (213) 825-2064 or Stewart D. Personick at (201) 671-4037 or Short Course Program Office at (213) 825-1295 or 825-3344.

The Continuing Education Institute is offering the following courses that may be of interest.

**SHORT COURSES:**

**CEI-LOS Angeles, CA**

(continued on page 37)

# BOOK RELEASE
## KALMAN FILTERING: THEORY AND APPLICATION

*The Kalman filter is "the most widely applied and demonstratably useful result to emerge from the state variable approach of 'modern control theory'."*

*by W.R. Crone*

*Kalman Filtering: Theory and Application* explains state-of-the-art applications and the fundamental theories behind this methodology. Among the 45 papers, assembled from world-wide sources, are those covering a broad range of Kalman filter applications, from spacecraft orbit determination to the demographics of cattle production.

Included with the application and theoretical papers are penetrating tutorials emphasizing the major contributions discussed in the reprinted papers.

The volume is divided into two parts and seven sections: Part 1 - Theoretical Beginnings; Historical Survey; Theoretical Foundations; General Application Considerations; Model Errors and Divergence; Divergence Control and Adaptive Filtering; Computational Considerations; Smoothing; Part 2 - Applications.

The extensive applications covered in this volume focus on the following areas:

orbit determination ... phased array radar tracking ... polar coordinates for bearings-only tracking ... manuevering target trajectories ... high-performance GPS Navigation ... techniques for terrain-aided navigation ... a recursive terrain height correlation system ... design and analysis of a dynamic positioning system ... dynamic ship positioning ... real-time prediction of aircraft carrier motion at sea ... aircraft track recovery system ... bathymetric and oceanographic applications ... natural Gamma Ray spectroscopy ... instantaneous flow rate ... estimation and prediction of unmeasureable variables in the steel mill soaking pit control system ... dead time processes ... nuclear power plant instrumentation ... power station control systems ... demographic models.

The editor, Harold W. Sorenson, Chief Scientist, United States Air Force, Washington, D.C., has published over 70 papers dealing with Kalman filtering, estimation theory, identification, optimization and control of stochastic systems. He is author of the book *Parameter Estimation: Principles and Problems*, a Past President of the IEEE Control Systems Society, and a member of the IEEE Board of Directors.

# BOOK RELEASE
## MONOLITHIC MICROWAVE INTEGRATED CIRCUITS

*by W.R. Crone*

In the past few years scientists have witnessed the emergence of a new microwave technology—monolithic microwave integrated circuits (MMIC's). This new technology is expected to exert a profound influence on microwave circuit designs for future military systems as well as the commercial and consumer markets.

*Monolithic Microwave Integrated Circuits* contains 82 key papers by experts in the field of MMICs. The book also includes a comprehensive tutorial introductory paper written expressly for this volume by the editor. The reprint papers are arranged in four main sections covering all phases of MMICs from design to testing. The titles of the sections are: 1- Design Considerations; 2- Materials and Processing Considerations; 3- Monolithic Circuit Applications; and 4- CAD Measurements and Packaging Techniques. The applications section is subdivided into these catergories: low-noise amplifiers and receiver circuits; power amplifiers; broadband amplifiers; transmit/receive modules; millimeter wave circuits; and special components and circuits. Each section and catergory is preceded by a short introductory summary.

This book is an excellent source of information for materials, device processing, and microwave engineers as well as graduate students in physics, chemistry and related technical fields. Specialists in research and development programs considering the inclusion of MMIC's in their future projects will find this book a valuable guide.

The editor, Robert A. Pucel is a Consulting Scientist at the Raytheon Company, where he has been a senior staff member of the Research Division since 1955. His research has encompassed both theoretical and experimental studies of most microwave semiconductor devices, especially their signal and noise properties. During the last seven years he has been heavily involved in the field of MMIC's. Dr. Pucel was a corecipient of the 1976 Microwave Prize granted by the IEEE Microwave Theory and Techniques Society. A Fellow of the IEEE, he is involved in many activities of the MTT Society. He was chosen by the society to be its National Lecturer during 1980-1981 on the subject of monolithic microwave circuits.

☐ **Business plans** that follow some simple rules have a much better chance of being read and accepted by investors. *Basics:* (1) Length not to exceed 40 pages. (2) A cover and title page with company name, address and copy number. (3) A two-page summary of the company's current status and future direction. (4) A table of contents and numbered pages. (5) Professional editing for grammar, clarity and organization. Sound simple? Perhaps, but huge numbers of business plans never make it past preliminary stages because they lack the right appearance.

*Business Plans That Win $$$* by Stanley R. Rich and David E. Gumpert, Harper & Row, 10 E. 53 St., New York 10022, $19.95.

(continued from page 30)

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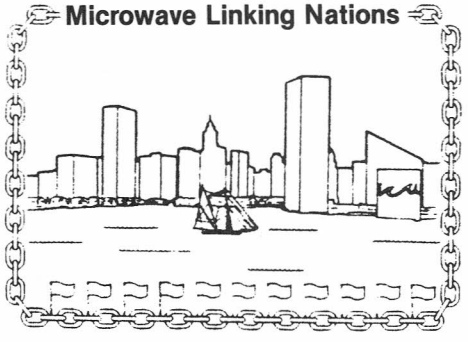


# 1986 IEEE PRINCETON SECTION SARNOFF SYMPOSIUM RCA LABORATORIES PRINCETON, NJ MARCH 14, 1986

## *"MICROWAVE AND MILLIMETER WAVE MONOLITHIC INTEGRATED CIRCUITS"*

The fourth IEEE Princeton Section Sarnoff Symposium will be held on Friday, March 14, 1986. The following people have agreed to present invited papers in the areas of microwave and millimeter wave monolithic integrated circuits:

S.C. Binari (Naval Research Lab., Washington, DC)
C. Chao (Honeywell, Minnetonka, MN)
C. Ghose (Tachonics/Grumman, New York, NY)
T.A. Midford (Hughes Aircraft Co., Torrance, CA)
A.F. Podell (Pacific Monolithics, Sunnyvale, CA)
R.A. Pucel (Ratheon, Waltham, MA)
T.B. Ramachandran (M/A-COM, Lowell, MA)
B.E. Spielman (Naval Research Lab., Washington, DC)
W.R. Wisseman (Texas Instruments, Dallas, TX)

Other papers describing *original work or reviews* on the subject are solicited. The areas of particular interest are: Materials, Device and Circuit Fabrication Technology, Components and Subsystems, Yield, and Reliability.

Authors are requested to send a summary explaining the contribution and relevance to the state-of-the-art. Three copies of the summary, suitable for reproduction in the digest, must be received *on or before January 10, 1986 by:*

Dr. Arvind K. Sharma
RCA/David Sarnoff Research Center
Princeton, NJ 08540
(609) 734-2387

Notice of acceptance or rejection will be mailed to the authors by February 14, 1986. All questions and inquiries for further information should be directed to:

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AND
THE IEEE ELECTRON DEVICE SOCIETY

(continued from page 31)

**Modern Microwave Measurements: Signal and Network Analysis Mirowave Products and Systems Characterization,** Feb. 17-20, 1986, Maui, Hawaii, Fee: $895. Contact: Registration Center Los Angeles CA (213) 824-9545 or Telex: 704789 CEI LA

**CEI - Europe**

**Modern Microwave Measurements: Signal and Network Analysis, Microwave Products, and System Characterization,** March 18-21, 1986, Arabella Conference Center, Munich, West Germany. Course number 167, Lecturer will be S. Adam, Adam Consulting Inc., Los Altos, CA-USA

**Microwave Circuits: Theory and Applications,** Apr. 14-18, 1986, Davos Congress Center, Switzerland. Course number is 168, Lecturers include — L. Besser, CGIS, Palo Alto, CA, USA. S. March, CGIS, Austin, TX USA. R. Wenzel, Wenzel/Erlinger Associates, Woodland Hills, CA, USA.

**Modern Spectral Analysis,** April 14-18, Davos Congress Center, Switzerland. Course number 174, Lecturers include R. Otnes, Time Series Associates, Palo Alto, CA, USA, L. Enochson, Time Series Associates, Spokane, WA, USA, L. Marple, Schlumberger Well Services, Houston, TX USA.

The Continuing Education Office of George Washington University is offering the following courses. These courses are to be held in Washington.

**The George Washington University School of Engineering and Applied Science Washington, D.C. 20052**

**Short Courses:**

**Radar Fundamentals with Emphasis on Airborne Applications,** Mar. 4-7, 1986 (in Washington, D.C.), Course No. 1276DC, Fee: $860 and includes lecture notes and indicated text(s). Contact: Dick White at (202) 676-6106 or toll free at (800) 424-9773 (within USA) or (800) 535-4567 (within Canada).

**Electronic Warfare Systems: Technical and Operational Aspects,** Mar. 10-14, 1986 and Jul 14-18, 1986, course No. 984DC, Fee: $920. Contact: Chip Blouin at (202) 676-6106 or toll free at (800) 424-9773 (within U.S.) and (800) 535-4567 within Canada.

**Introduction to Modern Radar Technology,** Mar. 10-12, 1986 (in Washington, D.C.), Course No. 1038DC, Fee: $750. and includes lecture notes and indicated text(s). Contact: Dick White at (202) 676-6106 or toll free at (800) 424-9773 (within USA) or (800) 535-4567 (within Canada).

**Vulnerability of Spread Spectrum AJ and LPE Communications Systems,** Mar. 17-20, 1986, (in Washington, D.C.), Course No. 632DC, Fee: $860. Contact: Cliff Hopkins at (202) 676-6106 or toll free at (800) 424-9773 (within U.S.) or (800) 535-4567 (within Canada).

**Electronic Scanning Radar Systems,** April 9-11, 1986 (in Washington, D.C.), Course No. 995DC, Fee: $750. and includes lecture notes and indicated text(s). Contact: Dick White at (202) 676-6106 or toll free at (800) 424-9773 (within USA) or (800) 535-4567 (within Canada).

**Radar System Analysis,** May 12-16, 1986 (in Toron- Canada), Course No. 1136, Fee: $950. Contact: J.W. Perkins at (202) 676-6106 or toll free at (800) 424-9773 (within U.S.) or (800) 535-4567 (within Canada).

**Radar Principles for the Nonspecialist,** Mar. 24-26, 1986 (in Orlando, Florida), May 20-22, 1986 (in Washington, D.C.). Course number 704, Fee: $750. and includes lecture notes and indicated text(s). Contact: Dick White (202) 676-6106 or (800) 424-9773 (within USA) or (800) 535-4567 (within Canada).

**ELINT: Analyzing Radar Signals,** May 28-30, 1986 (in Washington, D.C.), Course No. 1022, Fee: $750. Contact: Stod Cortelyou at (202) 676-6106 or toll free at (800) 424-9773 (within USA) or (800) 535-4567 (within Canada).

Arizona State University is offering the following courses.

**Center for Professional Development, College of Engineering and Applied Science, Arizona State University**

**Short Course:**

**Semiconductor Material and Device Characterization,** Mar. 3-5, 1986, Engineering Center, Arizona State University, Tempe, AZ. Fee $695. Contact: Center for Professional Development at (602) 965-1740.

**A Strategic Method for Writing:** A Seminar for Technical & Scientific Professionals, Mar. 6-7, 1986, Engineering Center, Arizona State University, Tempe, AZ 85287. Contact: Center for Professional Development (602) 965-1740. Fee: $395.

☐ **The typical American diet** has improved little over the last 10-20 years despite public interest in more healthful foods. The average American consumes 10% more refined sugar and corn sweeteners, 6% more fat, and only 6% less red meat than in 1970.

☐ **Several short vacations** may alleviate stress better than a single long trip. *Reason:* A long vacation can create family, professional and financial stress by itself.

Douglas Chalmers, associate professor of psychology, University of California.

# MEETINGS OF INTEREST

*The following list of meetings of potential interest to members of the Microwave Theory and Techniques Society covers a period of nearly a year. All efforts will be made to maintain a complete compilation of IEEE-sponsored and non-IEEE sponsored meetings. Any additions should be sent to the MTT-S Newsletter Editor.*

## 1986

- **Technology and Market FORECASTING in Electronics,** Feb. 11-12, Presented by Jeff D. Montgomery, San Jose, CA at Red Lion Inn. Contact: Futurecast Learning Center, 2121 S. El Camino Real, Suite 1215, San Mateo, CA 94403.
- **1986 IEEE International Solid-State Circuits Conference,** Feb. 19-21, 1986, Anaheim, CA. Contact: Lewis Winner, 301 Almeria Avenue, Coral Gables, FL 33134, Telephone: (305) 446-8193/4.
- **OFC '86,** Feb. 24-26, 1986, Atlanta Marriott Marquis Hotel, Atlanta, GA. Contact: Optical Society of America, 1816 Jefferson Place, N.W., Washington, DC 20036.
- **Conference on Optical Fiber Communication - OFC '86** — Feb. 24-26, 1986, Atlanta Marriott Marquis Hotel, Atlanta GA. Contact: OSA Meeting Department, 1816 Jefferson Place, N.W., Washington, DC 10036. (202) 223-8130
- **Topical Meeting on Integrated and Guided-Wave Optics (IGWO '86)** — Feb. 26-28, 1986. Atlanta Marriott Marquis, Atlanta, GA. Contact: OSA Meetings Department, 1816 Jefferson Place N.W., Washington, DC 20036 (202) 223-0920
- **IGWO '86,** Feb. 26-28, 1986, Atlanta Marriott Marquis Hotel, Atlanta, GA, Contact: Optical Society of America, 1816 Jefferson Place, N.W., Washington, D.C. 20036 (202) 223-0920
- **1986 International Zurich Seminar on Digital Communications: New Directions in Switching and Networks,** Mar. 11-13, 1986, Swiss Federal Institute of Technology (ETHZ), Zurich, Switzerland. Contact: Secretariat '86 IZS, Dr. R. Hartmann, Zellweger Uster AG. CH-8634 Hombrechtikon, Schweiz/Suisse/Switzerland Telephone: +055/ 416111 Telex: 875558
- **IEEE 1986 National Radar Conference (RADAR-86)** Mar. 12-13, 1986, Los Angeles, CA. Contact: Milton E. Radant, Hughes Aircraft Company, P.O. Box 92426, Bldg. R1, MS/D-428, Los Angeles, CA 90009 (213) 647-0134
- **SOUTHCON '86,** Mar. 18-20, 1986, Orange County Covention Center, Orlando, FL. Contact: Dale Litherland, Electronics Conventions, Inc., 8110 Airport Boulevard, Los Angeles, CA 90045 (213) 772-2965
- **SOUTHEASTCON '86,** Mar. 24-27, 1986, Holiday Inn - Downtown, Richmond, VA. Contact: V. Bodin, 7305 Longview Drive, Richmond, VA 23225 (804) 272-4735
- **SOUTHEASTCON '86, IEEE Region 3,** March 23-26, 1986, Holiday Inn, Richmond, VA. Contact: Val Bodin, Senior Engineer, SOUTHEASTCON '86, Department of Information Technology, Commonwealth of Virginia, 6th Floor, 805 East Broad Street, Richmond, VA 23219 (804) 786-7313
- **1986 International Reliability Physics Symposium,** Mar. 31-Apr. 4, 1986, Anaheim Marriott Hotel, Anaheim, CA., Contact: Lucian A. Kasprzak, 1986 International Reliability Symposium, IBM, 44 South Broadway, White Plains, NY 10601 (914) 686-5683
- **INTERMAG '86 Conference,** April 14-17, 1986, Phoenix, AZ, USA. Contact: Conference Chairman, J. U. Lemke, 2400 6th Avenue #1103, San Diego, CA 92101, or the Publicity Chairman, J. A. Nyenhuis, School of Electrical Engineering, Purdue University, West Lafayette, IN 47907 (317) 494-3524.
- **1986 Microwave Power Tube Conference,** May 12-14, 1986, Naval Postgraduate School, Monterey, CA. Contact: Program Chairman, Mr. Richard L. Remski, AFWAL/AADM, Wright Patternson AFB, OH 45433, (513) 255-4024/4831.
- **Custom Integrated Circuits Conference and Educational Sessions,** May 12-15, 1986, The Rochester Riverside Convention Center, Rochester, NY. Contact: Conference Chairman, Tom Foxall, Pacific Microcircuits Ltd., 240 H Street, P.O. F195-108, Blaine, WA 98230 (604) 536-1886 or Exhibits Chairman, David Lewis, Eastman Kodak Company, Research Laboratories, Rochester, NY 14650 (716) 477-7558.
- **MICONEX '86,** May 14-16, 1986, Winnipeg, Manitoba, Canada. Contact: Program Chairman, Dr. M. Barakat, National Research Council, 307 - 155 Carlton Street, Winnipeg, Manitoba R3C 3H8, Canada
- **The National Aerospace and Electronics Conference '86 (NAECON '86),** May 19-23, 1986, Dayton Convention Center, Dayton, Ohio. Contact: Igor V. Golovcsenko, 655 Ridgedale Road, Dayton, Ohio 45406
- **1986 IEEE International Symposium on the Application of Ferroelectrics** — June 8-11, 1986, Lehigh University, Bethlehem, Pennsylvania 18015. Contact: Betty Zdinak, Conference Coordinator, Dept. of Metallurgy & Materials Engineering, Lehigh University, Whitaker Laboratory #5, Bethlehem, PA 18015, U.S.A. Phone (215-861-4221)

- **International Quantum Electronics Conference (IQEC '86),** Jun 9-13, 1986, Moscone Convention Center, San Francisco, CA. Contact: John W. Roy, Hughes Aircraft Company, 6155 El Camino Real, Carlsbad, CA 92008

- **CLEO '86,** Jun. 9-13, 1986, Moscone Center, San Francisco, CA. Contact: John W. Roy, Hughes Aircraft Company, 6155 El Camino Real, Carlsbad, CA 92008

- **1986 International IEEE AP-S Symposium National Radio Science Meeting,** Jun. 9-13, 1986, Wyndham Franklin Plaza Hotel, Philadelphia, PA. Contact: Charles C. Allen, General Chairman, General Electric Company, Valley Forge Space Center, Room U4018, P.O. Box 8555, Philadelphia, PA 19101.

- **CPEM '86,** June 23-27, 1986, National Bureau of Standards, Gaithersburg, MD, USA. Contact: Judy Wilson, National Bureau of Standards (301) 921-2721.

- **Seventeenth Power Modulator Symposium,** Jun. 23-25, 1986, Hyatt Seattle, 17001 Pacific Highway South, Seattle, Washington. Contact: Leslie Gallo, Palisades Institute for Research Services, Inc., 2011 Crystal Drive, One Crystal Park, Suite 307, Arlington, VA 22202 (703) 769-5580.

- **Symposium with Seminars on Antenna Technology and Applied Electromagnetics,** Aug. 13-14, 1986, University of Manitoba, Winnipeg, Manitoba. Contact: L. Shafai, Department of Electrical Engineering, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2

- **International Symposium on Recent Advances in Microwave Technology and Future challenges,** August 15-16, 1986, University of North Dakota, Grand Forks, ND. Contact: Banmali Rawat, Department of Electrical Engineering PO Box 7165, University of North Dakota, 58202 (701) 777-4331

- **1986 International Conference on Solid State Devices and Materials,** Aug. 20-29, 1986, Tokyo Prince Hotel, Tokyo, Japan. Contact: Professor Takuo Sugano, Dept. of Electrical Engineering, University of Tokyo, Hongo, Bunkyo-ku, Tokyo, 113 Japan. Tel: (03) 812-2111 ext. 6675

- **1986 International Geoscience and Remote Sensing Symposium (IGARSS '86),** Sept. 8-11, 1986, University of Zurick-Irchel, Zurich, Switzerland. Contact: Prof. Dr. H. Haefner, General Cairman, Department of Geography, University of Zurich-Irchel, CH-8057 Zurich, Switzerland. Telephone: 01/257 51 31 Telex: 55575 unizi ch

- **IEEE International Symposium on Electromagnetic Compatibility,** Sept. 16-18, 1986, Town & Country Hotel, San Diego, CA. Contact: Vice Chairman & Publicity Chairman Mr. George Ufen, GRU Associates, 1105 E. Commonwealth Ave., Fullerton, CA 92631, (714) 738-0903.

- **1986 International Symposium on Information Theory,** Oct. 5-9, 1986, The University of Michigan, Ann Arbor, MI. Contact: Professors Frederick J. Beutler or David L. Neuhoff, or the Chairman for Local Arrangements, Professor Wayne E. Stark, Department of EECS, East Engineering Building, The University of Michigan, Ann Arbor, MI 48109

- **International Conference on Computer Aided Design,** Nov. 10-13, 1986, Santa Clara Convention Center, Santa Clara, CA. Contact: ICCAD, Ian Getreu, Tektronix, Inc., MS 94-520, P.O. Box 4600, Beaverton, OR 97075, (503) 629-1462

- **1986 IEEE Ultrasonics Symposium,** Nov. 17-19, 1986, Colonial Williamsburg Conference Center, Williamsburg, VA. Contact: R.A. Moore, Westinghouse Defense and Electronic Center, P.O. Box 746, MS-335, Baltimore, MD 21203. (301) 765-4027

- **Global Telecommunications Conference 1986 (GLOBECOM '86),** Dec. 1-4, 1986, Westin Galleria Hotel, Houston, TX. Contact: Mr. Ross C. Anderson, Southwestern Bell, Room 706, 3100 Main Street, Houston, TX 77002 (713) 521-8244

- **1986 International Electron Devices Meeting-IEDM '86,** Dec. 7-10, 1986, Los Angeles, CA. Contact: Ms. Melissa Widerkehr, Courtesy Associates, Inc., 655 15th Street, NW, Washington, DC 20005 (202) 347-5900

- **1987 Annual Reliability and Maintainability Symposium,** Jan. 27-29, 1987, Philadelphia Marriott, Philadelphia, PA. Contact: V.R. Monshaw, RCA, Astro-Electronics, P.O. Box 800, Mail Stop 55, Princeton,NJ 08540 (609) 426-2182

- **Phoenix Conference on Computers and Communications,** Mar. 8-12, 1987, Phoenix, AZ. Contact: Ike Templeton, Honeywell PMSD, 16404 North Black Canyon Highway, Phoenix, AZ 85023 (602) 997-3924

- **International Switching Symposium (ISS '87)** Mar. 15-21, 1987, Phoenix Civic Center, Phoenix, Az. Contact: Ed Glenner, GTE Network Systems, 2500 W. Utopia Road, Phoenix, AZ 85027 (602) 582-7792

- **International Switching Symposium (ISS '87) "Innovations in Switching Technology"** March 15-21, 1987, Phoenix, AZ, USA. Contact:

- **International Reliability Physics Symposium** Mar. 31-Apr. 1, 1987, San Diego, CA. Contact: H.C. Jones, Westinghouse Corporation, Mail Stop 3664, P.O. Box 1521, Baltimore, MD 21203 (301) 765-7387

- **1987 International Microwave Symposium/Brazil,** July 27-30, 1987, Rio Palace Hotel, Rio De Janerio, Contact: Prof. Alvaro Augusto A. de Salles, 1987 International Microwave Symposium Committee CETUC-PUC/RJ, Rua Marques de Sao Vicente, 225 - Gavea - CEP: 22451, Rio de Janerio - RJ, Brazil, Telex No. 2131048

Dr. Marilyn Machlowitz

**Workaholism...It isn't all bad**

If you're a workaholic, chances are that you...

☐ Get more done than most other people.

☐ Have a higher energy level than others.

☐ Don't feel the work pressure that would drive others to an anxiety crisis.

☐ Usually feel that you have control over your life and career.

*Problems:* Workaholics run the risk of alienating coworkers. At the office, that can quickly undo all the extra hours they've put in. They also run the risk of misapplying their energy and not coordinating their efforts with those who work at a different pace.

If workaholics allow their compulsion to dominate them, valued subordinates may resign in frustration over not having sufficient access to their workaholic boss. Others will leave simply because they feel unable to keep up with their hard-driving leader or because they're made to feel guilty about not working as hard. Most of the harm caused by workaholism comes from its side effects...from the workaholic's inability to turn all his efforts into actual productivity. *To make it work...*

☐ *Gain perspective.* Try to see your work as a part of the entire company's efforts.

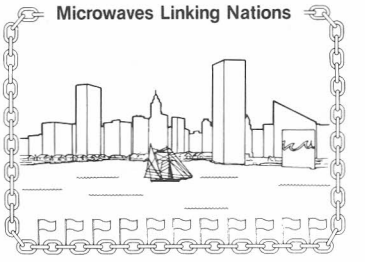
☐ *Soften the hard edges* that workaholism usually produces.

*Be courteous.* Using terms like *please, thank you* and *well done* is a small investment to make for the substantial payoff it brings in staff morale.

*Make schedules.* Block out an hour a week, or maybe two, to have coffee with key staff people. This will help to defuse their frustration over your inaccessibility or furious pace.

*Communicate priorities.* Instead of just expecting subordinates to jump when you call, organize the work flow so they know what to expect.

When possible, *work outside the office.* This will give your staff needed breaks from the climate of intensity you create when you're around.




**HOW TO TELL A FINE BEER BY SIGHT**

Use a tulip-shaped glass or a large brandy snifter. The beer should be at about 50° (a bit warmer than refrigerator temperature). Pour it *straight down* the center of the glass. Side pouring is necessary only if the beer has been jostled or insufficiently chilled. *Now look for the three visual signs of excellence:*

(1) Small bubbles that continue to rise for several minutes.
(2) A dense head, one and one-half to two inches high, that lasts.
(3) No trace of cloudiness.

After drinking, look for the clear "Brussels lace" tracery that should remain on the inside of the glass.

The quality of beer varies almost as widely as the quality of wine...but the difference in price between the worst and the best is far narrower. Unlike wine, beer can be judged visually. Like wine, taste is the ultimate test.

**BEER RATINGS**

*Best American regular beers:*
- Anchor Steam Beer (San Francisco).
- New Amsterdam Amber Beer (New York City).

*Best dark beers:*
- Prior Double Dark Beer.
- Sierra Nevada Porter.
- Sierra Nevada Stout.

*Best beers to go with meals:*
- Kronenbourg (from France).
- Kirin (from Japan).

**TO BUY AND STORE BEER**

- Be sure the bottles are filled to within one and one-half inches of the top.
- Buy bottles instead of cans. Avoid twist-cap bottles, if possible.
- Try to buy refrigerated beer that has not been exposed to fluorescent light.
- Store bottles upright at 40°-50°. Avoid agitating the bottles in transit or in storage. (For example, do not put them on the door shelves of a refrigerator).
- Do not store beer for long periods.
- Do not quick-chill beer in the freezer.

*The Gourmet Guide to Beer* by Howard Hillman, Pocket Books, 1230 Ave. of the Americas, New York 10020, $5.95.

# CALL FOR PAPERS

The 2nd International Microwave Symposium/ Brazil, organized by the Brazilian Microwave Society (SBMO) in cooperation with the IEE, IEEE, IEEE MTT-S, IEEE AP-S, IEEE ED-S, will be held on July 27-30, 1987 at the Rio Palace Hotel, Rio de Janerio, Brazil.

It is intended to provide a major international forum for the exchange of information on research and development in the fields of microwaves; antennas and propagation, including millimeter waves and optics.

## TOPICS COVERED

Papers are solicited describing original work on the following topics:

- Antennas and Arrays
- Microwave Radio Propagation and Radiometeorology
- Terrestrial and Satellite Communication Systems
- Microwave Active/Passive Devices and Components
- Millimeter Wave Components, Circuits and Systems
- Microwave Hybrid and Monolithic Circuits
- Microwave Techniques in Radar, ECM, Remote Sensing and Radio Astronomy
- Microwave Measurements
- CAD/CAM
- Scientific, Biological, Medical and Industrial Applications of Microwaves
- Optical Communications
- Field and Network Theory

## PREPARATION OF PAPERS

The papers must be written in English and should not exceed six pages including text, figures, photographs, tables and references. The text should be typed single space on white bond paper measuring 21.5 x 28 cm (8 1/2 x 11 inches) on one side only. The title should be centered in capital letters 2.5 cm (one inch) from the top on the first page. The author's name, the affiliation and the address should start two lines below the title, and the text should start three lines below this, with an abstract (maximum 50 words), followed by the introduction and other sections. Left and right-hand margins should be 2.5 cm (one inch). Also, a 2.5 cm (one inch) margin should be left at top and bottom of all pages. Double space should be left between paragraphs. The digest will be produced directly from the originals of the accepted papers. Footnotes should not be used. Pages have to be numbered in pencil. Figures should be in black ink and clearly legible and photos must be glossy, black and white prints.

## SUBMISSION OF PAPERS

Send the typed original and three copies of the paper together with the full address of the author(s) and the telephone or telex number to:

Prof. Alvaro Augusto A. de Salles
1987 International Microwave Symposium Committee
CETUC-PUC/RJ
Rua Marques de Sao Vicente, 225 — Gavea — CEP: 22451
Rio de Janerio — RJ — Brazil, telex no. 213048

The deadline for the receipt of the papers is **December 31, 1986**. Advanced submission is encouraged. Authors will be notified of acceptance of their papers by the end of February 1987.

# BOOK RELEASE
# MONOLITHIC MICROWAVE INTEGRATED CIRCUITS

*by W.R. Crone*

In the past few years scientists have witnessed the emergence of a new microwave technology—monolithic microwave integrated circuits (MMIC's). This new technology is expected to exert a profound influence on microwave circuit designs for future military systems as well as the commercial and consumer markets.

*Monolithic Microwave Integrated Circuits* contains 82 key papers by experts in the field of MMICs. The book also includes a comprehensive tutorial introductory paper written expressly for this volume by the editor. The reprint papers are arranged in four main sections covering all phases of MMICs from design to testing. The titles of the sections are: 1- Design Considerations; 2- Materials and Processing Considerations; 3- Monolithic Circuit Applications; and 4- CAD Measurements and Packaging Techniques. The applications section is subdivided into these catergories: low-noise amplifiers and receiver circuits; power amplifiers; broadband amplifiers; transmit/receive modules; millimeter wave circuits; and special components and circuits. Each section and catergory is preceded by a short introductory summary.

This book is an excellent source of information for materials, device processing, and microwave engineers as well as graduate students in physics, chemistry and related technical fields. Specialists in research and development programs considering the inclusion of MMIC's in their future projects will find this book a valuable guide.

The editor, Robert A. Pucel is a Consulting Scientist at the Raytheon Company, where he has been a senior staff member of the Research Division since 1955. His research has encompassed both theoretical and experimental studies of most microwave semiconductor devices, especially their signal and noise properties. During the last seven years he has been heavily involved in the field of MMIC's. Dr. Pucel was a co-recipient of the 1976 Microwave Prize granted by the IEEE Microwave Theory and Techniques Society. A Fellow of the IEEE, he is involved in many activities of the MTT Society. He was chosen by the society to be its National Lecturer during 1980-1981 on the subject of monolithic microwave circuits.

IEEE 1986

# ULTRASONICS SYMPOSIUM

NOVEMBER 17–19, 1986

COLONIAL WILLIAMSBURG, WILLIAMSBURG, VA

Sponsored by The Ultrasonics, Ferroelectrics and Frequency Control Society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Williamsburg

# First Call For Papers

**Deadline: Monday, June 23, 1986**

Papers are solicited describing original work in the field of Sonics and Ultrasonics. Papers concerned with mechanical wave phenomena, including the topics suggested below, will be considered.

**GROUP 1:**

| | |
|---|---|
| ABS | Arrays and Beam Steering |
| BB | Bioeffects and Biophysics |
| HT | Hyperthermia |
| IS | Inverse Scattering |
| MU | Medical Ultrasonics |
| PF | Piezoelectric and Ferroelectric Materials |
| TC | Tissue Characterization |

**GROUP 2:**

| | |
|---|---|
| AE | Acoustic Emission |
| AM | Acoustic Microscopy |
| CU | Consumer Ultrasonics |
| DMC | Defect and Material Characterization |
| IU | Industrial Ultrasonics |
| NDE | Nondestructive Evaluation |
| PMC | Process Monitoring and Control |
| SEN | Sensors |

**GROUP 3:**

| | |
|---|---|
| AO | Acousto-Optic Effects and Devices |
| AOS | Acousto-Optic Signal Processing |
| BW | Bulk Wave Effects and Devices |
| MSW | Magnetostatic Waves and Devices |
| PA | Physical Acoustics |
| PAS | Photoacoustics |
| PM | Porous Media |
| TFB | Thin Films (Bulk & Optical Devices) |

**GROUP 4:**

| | |
|---|---|
| ACE | Acousto-Electric Effects and Devices |
| SFT | SAW Filters and Transducers |
| SMP | SAW Materials and Propagation |
| SRO | SAW Resonators and Oscillators |
| SSA | SAW System Applications |
| SSP | SAW Signal Processing |
| TFS | Thin Films (Surface Wave Devices) |

Authors of contributed and invited papers are requested to submit an abstract, using the format on the third page to:

Prof. James G. Miller
% LRW Associates
1218 Balfour Dr.
Arnold, MD 21012

The abstract original (unfolded) and 20 copies should be provided.
Deadline for receipt of abstracts is **Monday, June 23, 1986.**

A good abstract clearly explains the paper's contribution, the originality of the work, why the work was done, and the results.

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 August 1, 1986.

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## AUTOMATIC RF TECHNIQUES GROUP

PLEASE REPLY TO:

# ANNOUNCEMENT

CALL FOR PAPERS

ARFTG 27th Conference - Spring 1986

FIRST CALL FOR PAPERS

Baltimore, Maryland
June 5th and 6th, 1986

The Automatic RF Techniques Group will hold their 27th Conference on June 5th and 6th, 1986 in Baltimore, Maryland at the Sheraton Hotel in conjunction with the 1986 IEEE/MTT-S International Microwave Symposium.

The theme for this meeting will be "Pulsed-RF Automated Measurements". Papers are solicited on recent hardware and software developments on this topic as well as other areas involving computer-aided RF measurement and design. Manufacturers are encouraged to discuss and demonstrate new product developments for automated RF/microwave design and testing.

Technical presentations shall be informal twenty-five minute talks using viewgraph or 35-mm slide illustrations. Authors are requested to submit a one-page abstract and a 500 to 1,000 word summary with attachments containing illustrations, etc., providing sufficient technical content to enable proper evaluation and explaining the contribution's usefulness to the conference attendees. Please refer to "ARFTG Instructions to Authors" for further information. All accepted papers will be published in the conference digest. Two copies of the abstract and summary should be sent by March 28, 1986 to Jim Manning, Technical Program Chairman.

Manufacturers should contact Darlene Payette, Assistant Exhibits Coordinator, for information and an application/agreement form.

The ARFTG banquet will be held on June 5, 1986.

Send papers to:
Jim Manning
Westinghouse Electric Corporation
P.O. Box 746, MS 282
Baltimore, MD 21203
(301) 765-6109

Send exhibit application to:
Darlene Payette
Maury Microwave Corporation
8610 Helms Avenue
Cucamonga, CA 91730
(714) 987-4715 Ext. 45

For further information, contact the ARFTG Conference Chairman:
Richard Irwin
Systems For Automatic Test
420 Persian Drive
Sunnyvale, CA 94089
(408) 734-9447