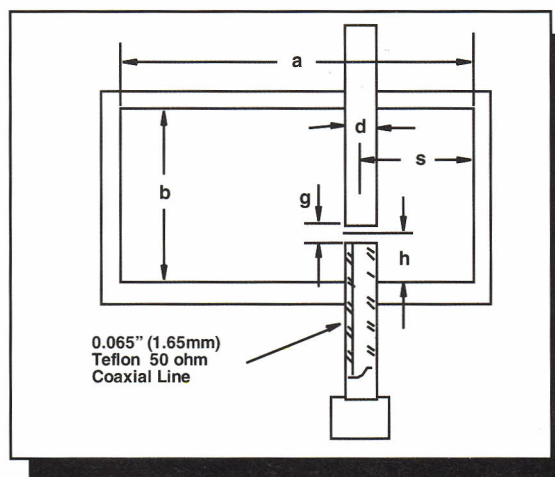
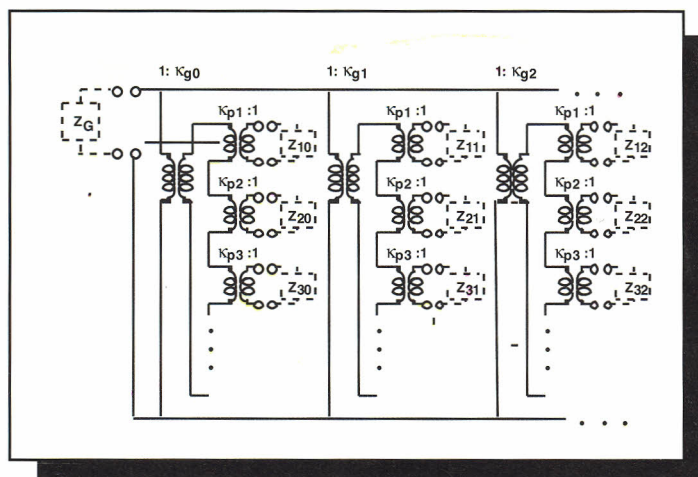
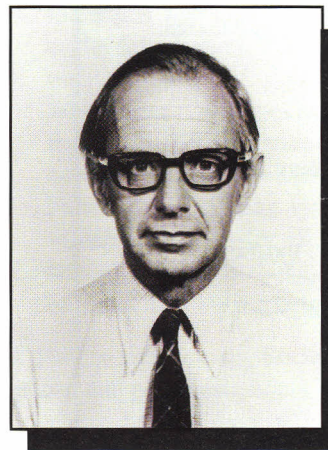
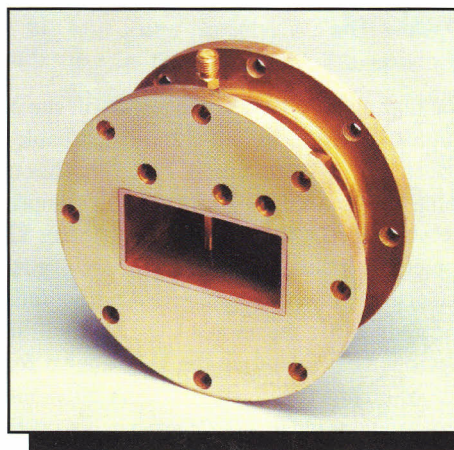




1999 Microwave Pioneer Award Honorees Robert L. Eisenhart and Peter J. Kahn



See article on page 24 for discussion and details.

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President's Message



Edward Rezek
President

1999 is shaping up to be a pretty exciting year and it looks like that's only the beginning. To begin with, let me tell you that our Society has never been in better shape. Financially we have a surplus of nearly \$5 million dollars, which puts us in the top 5 of all IEEE Societies. Our surplus has grown in the last few years as the result of two factors: strong growth in the net revenue from the International Microwave Symposium and a good return on our share of the IEEE investment portfolio. Our membership grew over 10% last year. We ended 1998 with over 10,400 members, the highest total since 1991. Our financial picture allows us to continue to invest in our Society's future. The Administrative Committee has many ongoing or planned initiatives that promise to support our membership and advance the microwave profession. In this article I'll provide some insight on some of these activities.

The highlight of 1999 is the release of the **Microwave Digital Library** on CD-ROM in August. This is a complete, fully searchable archive of the MTT Society's published material since its foundation in 1953. This has taken us over 2 years and nearly half a million dollars to produce. The Library will comprise 18 CD-ROMs and will be sold to Society members for \$100 and IEEE members for \$200. The pre-publication price is only \$50 for Society members. This CD-ROM archive is part of a larger MTT Digital Library project that also includes a Cumulative Abstract Index and an Annual CD-ROM. The CAI will be updated yearly; the annual CD-ROM will include all of the society publications for the previous year including the IMS Digest for the previous year. These will be provided free-of-charge to Society members upon membership renewal. Non-Society IEEE members can upgrade to MTT membership on-line by going to <http://www.ieee.org/ra/md/>.

Continuing with **electronic publications**, all Society members should be aware that the IEEE OPeRA (On-line Periodicals Research Area) program provides an electronic version of the full text of every issue of the IEEE MTT-S Transactions and the IEEE Microwave and Guided Wave Letters Journal as soon as they are published. At no cost. We also have a reciprocal agreement with the Electron Devices Society that allows MTT-S members access to all on-line ED-S publications at no cost. Simply log on to OPeRA at <http://www.opera.ieee.org/> to take advantage of this service.

We are also rolling out a new electronic product, the **Microwave Multi-Media Module**. The objective of this product is to deliver a multi-media, electronic learning tool for the continuing education and/or training of practicing engineers and graduate students in a specific microwave field. In late 1998 we solicited proposals for this program from academia and industry and were encouraged by the response. We are in the process of evalu-



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Protocol: David F. Wait; University Relations: Dick Ehret; Publications Support: Charles M. Jackson, Don Huebner, Joseph Donovan; Publicity Support: George Rinard, Jeffrey Jargon; Signs: Christie Whitehead;

MTT-S AdCom Liaison: Karl Varian; Industry Relations: Dick Loewecke, Robert O'Rourke; Historical Exhibit: Dave Russell

ating proposals that focus on a varied nature of microwave topics. We plan to have the first modules completed by the end of 1999. The method of delivery to our members is still under review. This product is being managed by Karl Varian. If you have any constructive ideas or potential proposals, please contact Karl.

The MTT-S **Winter Technical Meeting**, held immediately prior to the Technical Program Committee meeting of the International Microwave Symposium, has evolved in the last few years into an outstanding technical workshop on new and emerging technologies. We are considering the possibility of using the Winter Meeting package to develop a stand-alone workshop that could be offered to interested Society Chapters. Our Society has also initiated a **Speaker's Bureau**, operated under the Technical Committee. The intent is to make a wider variety of technical speakers available to local Chapters than is possible with the Microwave Distinguished Lecturer program. We now have roughly 20 speakers available to provide insight on topics from established technology to emerging and revolutionary technologies. Anyone interested in taking advantage of the Winter Technical Meeting package or the Speaker's Bureau should contact Tim Kemerley.

The **1999 International Microwave Symposium** will be held in Anaheim, California, USA from 11 June to 17 June. The IMS Chairman, Bob Eisenhart, and his committee are well in control of preparations for this year's Microwave Week. Anaheim will see a record number of microwave exhibitors as well as the usual package of outstanding technical presentations, panel sessions, and workshops. Over 10,000 microwave professionals will be at the 1999 IMS, I hope you will be one of them. If you miss this year's Microwave Week begin making plans now to attend next year in Boston, Massachusetts USA.

I would like to take this time to encourage various Chapters to consider **hosting an IMS**. The IMS does two things: it provides a forum for the dissemination of the most current and topical microwave technical information in the world and it serves as a

driving mechanism to strengthen and invigorate Society Chapters. It is both an honor and a challenge to host an IMS. Every Chapter that has hosted an IMS has found it to be an extremely rewarding and satisfying experience. Any Chapter interested in hosting a future IMS should contact the Meetings & Symposia Committee.

Other newsworthy items:

- **50th Anniversary.** 2002 will mark the official 50th anniversary of the MTT Society. George Oltman is heading a committee to plan an appropriate celebration. Feel free to contact George for information or to offer support.
- **IEEE Councils.** The MTT Society is a member of the governing administrative board for three new IEEE Councils. An IEEE Council is established to address emerging professional technical areas; often a Council will mature into a new Society. We are participating in the Intelligent Transportation Systems Council, the Sensors Council, and the Superconductivity Council. MTT-S members interested in these Councils are encouraged to contact Ed Rezek for details.
- **Electronic Products.** Roger Pollard, 1998 Society President, is the Chairman of the IEEE TAB Electronic Products Initiative Committee (EPIC). The IEEE has aggressively taken on the task of electronic publication. The charter of EPIC is to establish an IEEE entity that will foster and champion all products/services including electronic implementation. The Institute is expecting great things from this committee and Roger is just the right person to deliver.
- **Electronic Products Revisited.** As technologists, we would all like to have the most up-to-date technical information available to us with minimum difficulty. Electronic publication, on-line publication, etc. would be a desirable thing. One serious drawback to electronic publication has been archiving and citation of these publications. The IEEE has successfully negotiated with

INSPEC to start citing electronic versions of publications. We expect this to open the doors to increased use of this medium.

- **Good-bye Newsletter.** We are in the process of converting the familiar MTT-S Newsletter into a magazine. The magazine would include the same content of the Newsletter but would also offer tutorials, articles on applications, and significantly higher technical content. The magazine would be distributed quarterly beginning in 2000 and would be included with Society membership at no cost. Final details and approval is still being worked with the IEEE.
- **Web Page.** The Society web page continues to develop and provide up-to-date information. It contains information on meetings and conferences, links to Chapter web sites, and a host of other useful information. The information is only accurate if you all tell the WebMaster of changes and provide information about activities. We have a new WebMaster for 1999: Jeff Pond. Please help us make our web site a valuable resource for all of our members. You will find the Society web page at <http://www.mtt.org/>.

I'd like to welcome any Society member to attend and participate in our next **AdCom meeting**, held immediately prior to the June 1999 Anaheim International Microwave Symposium. The meeting will be at the Anaheim Marriott, headquarters hotel for the IMS, and will begin on Saturday, 11 June at 8 p.m. The meeting will conclude on Sunday, 12 June 12 at 4 p.m.

I am very excited about our accomplishments so far this year and am looking forward to what the remainder of 1999 will bring. I pledge my continued efforts to the support and development of the careers of our members and the advancement of the microwave profession. I hope that you share my enthusiasm and will be active in your local Chapters as well as regional and international Society events. The new millennium is almost here; I hope it's ready for us. 

MTT Society Ombudsman



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I have been selected by the Microwave Theory and Techniques Society Administrative Committee (ADCOM) to continue serving as your Ombudsman for 1999. It was a pleasure to serve in previous years and I look forward to continuing in 1999. The purpose of the Ombudsman is to receive complaints and assist members in solving problems encountered obtaining membership services from IEEE and MTT-S.

As your Ombudsman in 1998, I received 80 inquiries and suggestions (43 non-US) from MTT-S members. This is slightly higher than the 71 received in 1997.

All of the inquiries were made by e-mail, which is convenient for me to answer. Responses were made to all requests.

Twenty-one members needed information concerning the 1998 MTT-S International Microwave Symposium. These questions were easy for me to answer, since I was the technical program chairman of the symposium. Thirteen members wanted to receive the MTT-S Transactions and or MTT-S Microwave and Guided Wave Letters and were not receiving them. In checking with IEEE it was found that when they joined MTT-S they had chosen not to receive the

publications. The basic MTT-S membership cost of \$8/year (\$4 students) with a \$40 permanent fee good as long as you pay IEEE dues. MTT-S membership includes the MTT-S newsletter and other member services. For an additional cost, members are given the choice of subscribing to the MTT-S Transactions for \$13 /year (students \$10), the MTT-S Microwave and Guided Wave Letters for \$8/year (students \$6), or both for \$21/year (students \$16). This way members can choose what they want. I informed the members that they need to request the periodicals from IEEE. Members can call in their order using a credit card. Toll free in US (800) 678-4333 or (732) 981-0060. Members can also FAX in their order with credit card number, type and expiration date to the following number: (732) 562-6380 Attention Member Services. Members can e-mail their order using their credit card number, type, and expiration date. E-mail number is: member.services@ieee.org. Seven members requested missing issues, which were mailed to them.

Four members wanted information on the MTT-S CD-ROM. I informed them that the MTT-S has archived all published material since 1953 into a CD-ROM set. The Transactions on Microwave Theory and Techniques, the Symposium Digests, and the Microwave and Guided Wave Letters are now available for PC, Macintosh, and UNIX platforms. MTT-S Members can now order the multi-CDROM Microwave Digital Archive for \$50. Call, Fax, E-mail, or mail your order.

- Call IEEE at 1-800-678-4333 for US and Canada, or call 1-732-981-0060.
- Fax 1-732-981-9667.
- Or e-mail customer.service@ieee.org.
- Mail your order to IEEE Customer Service Center 445 Hoes Lane, PO BOX 1331, Piscataway, NJ, 08855-1331
- All payments must be US dollars, drawn on US banks.
- IEEE Product Number: JP-17-0-0-C-0
- ISBN: 0-7803-9906-4

The pre-publication offer ends on July 15, 1999, and the publication price will take effect. The post publication price is \$100 for MTT members, and \$200 for IEEE non

MTT members. We plan to ship them August 1, 1999 (Subject to change)

Three members needed the 1997 MTT-S CD-ROM which was mailed to them. I received two requests in each of the following areas: MTT-S editors address, guidelines on preparing an article for MTT-S, change of address, expense reimbursement, IEEE membership card, and a technical question.

I received one request in each of the following areas: Life member wants free Transactions and M&GW letters, DML contact information, chapter chairman contact, awards nomination, financial support, booth at IMS-99, Senior member application status, ADCOM meeting dates, address of an MTT-S member, membership status, IEEE alias e-mail number, resolution on MTT-S paper rejection, address of the MTT-S president, IEEE renewal notice, MTT-S Transaction article information, call for papers, purchase of 98 IMS and RFIC Digest (not attending), suggestions on getting response from ECM editor, e-mail numbers of MTT-S technical committee chairmen, and e-mail numbers of 2 members,

All requests were acted upon. Many of the above requested information can be found on the MTT-S Web page. See <http://www.mtt.org/>. Digests as well as any other periodicals can be ordered through IEEE by calling IEEE toll free in US (800) 678-4333 or (732) 981-0060, and asking for order department.

If you have been involved in electrical engineering (engineer, teacher, etc.) for 10 years with significant experience for 5 years, you can apply for senior member of the IEEE. Call IEEE and ask for a senior member application toll free in US at (800) 678-4333 or (732) 981-0060. After the material has been submitted to IEEE, you can check on the status of the application by contacting Denise Howard at (732) 562-5502 or E-mail: d.howard@ieee.org.

Please feel free to contact me by letter, telephone, or e-mail concerning any complaint you may have or any assistance you may need in obtaining membership services from IEEE and MTT-S. 

Microwave Multi-Media Module (M4) Karl Varian for M4 Committee

The objective the Microwave Multi-Media Module (M4) effort is to stimulate a multi-media approach whose end goal would be the continuing education and/or training of practicing engineers and graduate students in a specific microwave field with the various electronic tools presently available. The end product is not intended to be a lecture or an instruction manual, but an engaging learning tool and to be used as a reference source (such as an electronic book or chapter(s) of a book). Liberal use of hyperlinks will be made (Table of contents, text, and index) to permit quick reference to desired information and a means of searching for specific words (or terms) will also be provided.

On 15 October 1998, the M4 Committee [Dr. K.C. Gupta, Dr. Tatsuo Itoh, Dr. Wayne Shiroma, Dr. Michael Steer, and Mr. Karl Varian] solicited bids for this effort that were due by 15 December 1998. The responses were evaluated on a technical, capability, cost, schedule, and broadbased interest and usefulness to MTT members. Of the responses received, the Microwave Multi-Media Module Committee announces the award of two contracts for the purpose of generating Microwave Multi-Media Modules. The winners of the contracts are:

Dr. Afshin S. Daryoush (Drexel University), *"Microwave Engineering Education using Web Based Instruction"*

and

Dr. L. P. Dunleavy and Dr. T. M. Weller (University of South Florida), *"Microwave Multi-Media Virtual Laboratory Modules based on the University of South Florida's Wireless and Microwave Instructional (WAMI) Laboratory"*

A brief summary of the proposed activity follows.

Microwave Engineering Education using Web Based Instruction

Dr. Afshin S. Daryoush
(Drexel University)

The goal of this proposed project is to development of an electronic tool for instruction

of fundamental and sophisticated microwave concepts. This multimedia tool to be available in CD-ROM form and on a web site maintained by Drexel University will provide interactive education using engaging multi-media methods to graduating students, practicing engineers, and graduate students. The module will be prepared in the format of an electronic book, filled with many practical design examples.

Topics presented in the electronic book emphasize both fundamental understanding and practical issues encountered by microwave engineers. These topics cover both electromagnetic fields, waveguiding and signal transmission, and signal flow in passive and/or active microwave circuits. A series of practical problems are designed, realized, and simulated using various transmission line structures and the results are graphically presented. Computer Aided Design (CAD) tools are employed for accurate prediction of circuit performance. For TEM line structures, simulated results from HP-EESOF are converted to HTML files. The non-TEM transmission structures are ported from High Frequency Structure Simulator. For oscillator close-in to carrier phase noise Harmonica will be used as the simulation tool. Drexel University has established site licenses for distribution of popular web based software packages.

The proposed examples will provide education based on the "post page" and "hint page" concepts. In particular the proposed examples educate students by comparing the microwave circuit performance of simple and sophisticated models. Unfortunately many practical limitation prohibits "interactive page" at the moment. However it is anticipated that with the computer industry's technological innovations, cost and memory limitations which prohibits data storage and mining of interactive problem to be solved.

Microwave Multi-Media Virtual Laboratory Modules based on USF's WAMI Laboratory

Dr. L. P. Dunleavy and
Dr. T. M. Weller
(University of South Florida)

This project will generate electronic media derived from well-conceived tutorials and associated experiments covering a range of wireless and microwave topics at an introductory level. The media will be based on one or more courses taught in The University of South Florida's Wireless and Microwave Instructional (WAMI) Laboratory (see http://ee.eng.usf.edu/research_labs/WAMI/). This effort will result in at least two multimedia "virtual laboratory" (VL) experiments and an electronic book with a set of tutorials and laboratory procedures for the WAMI undergraduate laboratory course. One of the important aspects of the WAMI lab introductory class is that almost every one of the 14 lab experiments includes some form of correlation between measurements and simulations. The other aspect that has made the class a success is its combined treatments of component level and system level contexts. Consequently, the WAMI lab is a fertile environment for development of VL's related to wireless circuit and systems CAD and experimental validation.

The WAMI VL interactive modules are anticipated to be very useful as a self-study tool for practicing engineers. The electronic courseware for the WAMI Class will be of use to any company or university wishing to develop or update basic training or educational materials for new RF/Microwave engineers. It could be used in place of the current hard copy "course pac" for USF students taking the course each semester. The lecture tutorials and at least a subset of the laboratory procedures that will be contained in the electronic book portion of the material could also be used for self-study by practicing engineers. 

MTT-S Tutorials and Short Courses

Education Committee needs members' feedback

**K.C. Gupta, Chair,
MTT-S Educational Committee**

In addition to its other activities (graduate fellowships, RF/ Microwave Education Forum, and sponsorship of workshops/special-sessions etc.); Education Committee of MTT Society has initiated a plan to organize and/or sponsor tutorials or short courses on emerging topics of interest to MTT members. A tutorial on "Theory and Practice of Numerical Electromagnetics" will be offered by Prof. Wolfgang Hoefer and Dr. Dan Swanson at the IMS Symposium this year. We are planning to increase the tutorials/short-courses activity in future. In order to make this activity more useful for

members, we are soliciting feedback that will help in better organization. A sub-committee of Education Committee consisting of Professors Wolfgang Hoefer, Roberto Sorrentino, and K.C. Gupta is planning this activity. Please respond by e-mail to w.hoefer@ieee.org

1. Please tell us the topics on which you will like to see tutorials and short-courses to be organized. Current proposals include topics like RF Power Amplifiers – Classes A through S, and Applications of ANNs to RF and Microwave Design.

2. What is the appropriate technical/academic level for these tutorials? Senior undergraduate or graduate? One could start from basics and build up to a level that enables participants to understand the current literature on the topic and/or design items related to the topic of the tutorial.

3. Convenient length of tutorials? Half-a-day, full day, two days, etc.

4. Would you like to see these tutorials to be held in conjunction with the IMS Symposium or separately? As you know the Symposium week is already crowded. Other possibilities are in January in conjunction with the TPC meeting, in conjunction with other MTT-S sponsored conferences, or as separate self-standing events.

5. Would you like these tutorials to move to various locations, say hosted by various MTT-S Chapters?

6. What do you consider a reasonable registration fee for a typical one-day tutorial? \$300, \$200, \$100 etc.

Please share your thoughts. 

Graduate Fellowship Program

Graduate students who are members of MTT-S and who are actively involved in research in any area of microwave technology are invited to compete for the Graduate Fellowships offered by the society.

MTT-S Graduate Fellowships are awarded yearly and are designed to encourage and reward high caliber research in microwave technology. Other than the requirement that both the student and faculty advisor be a member of MTT, there are few restrictions to participating in this competition.

In rare cases even this requirement may be waived at the discretion of MTT. There are no citizenship constraints what so ever and no restriction to the type of research as long as it relates to microwave technology. The odds of winning are surprisingly high - one in seven in 1998!

Four graduate students - Fernando Teixeira (University of Illinois), Bruce Green (Cornell University), Balasundaram Elamaram (University of Leeds) and Martin Kaleja (Technische Universität München) - were awarded

1998 MTT-S Graduate Fellowships at the Plenary Session of the International Microwave Symposium in Baltimore. The award consisted of a Certificate of Recognition and a prize of \$5000.

Further information about this program can be found in the MTT web page at "<http://www.mtt.org>" or by contacting: Dr. Aditya Gupta, Northrop Grumman Corporation, Advanced Technology Center, MS 3K13, 1212 Winterson Road, Linthicum, MD 21090, USA (email: a.gupta@ieee.org). 

Microwave Digital Archive Update

As of the middle of February, when this article was submitted, a total of 15 CDROM prototypes have been completed. This includes all of the reviewed material from 1953 to 1993 including the Transactions on Microwave Theory and Techniques, the Guided Wave Letters, and the Symposium Digests (IMS and RFIC).

As of this time, over a hundred prepublication orders have been placed. Prepublication orders will help us decide how many CDROM sets to manufacture.

We are on schedule to complete the prototypes and index well before the 1999 International Microwave Symposium in

Anaheim California this June. We plan on demonstrating the set near the membership booth. The plan is to ship the first sets in August of 1999.

Amir Mortazawi has taken the lead in preparation of the 1998 Annual CDROM. Amir is on the publication

committee serving under Bob Trew. We are moving ahead to make the annual CDROM updates part of MTT's publication process. Our MTT Society plans to issue the annual updates for a few more years, and then will decide the best plan for the future. For now, the annual CDROM is part of your MTT membership, and will be included in your fall or winter newsletter.

I'm really impressed with the German MTT/AP Section; within a few days of receipt of a jpg image that announced the CDROM project, they placed the information of their website! Contact c.jack-

son@ieee.org if you would like to get a copy of the jpg announcements to pass around, or to post on your website. An order form is also available for members that need a form to place an order. The IEEE has an order form on the web at <http://www.ieee.org/products/ordform.html>.

To place your order, call IEEE at 1-800-678-4333 for US and Canada, or call 1-732-981-0060. Fax 1-732-981-9667. Or e-mail customer.service@ieee.org. Mail your order to IEEE Customer Service Center 445 Hoes Lane, POBOX 1331, Piscataway, NJ, 08855-1331

The 50\$ pre-publication offer ends on July 1, 1999, and the publication price will take effect. The post publication price is \$100 for MTT members, and \$200 for IEEE non MTT members. We plan to ship them August 1, 1999 (Subject to change)

IEEE Product Number: JP-17-0-0-C-0
ISBN: 0-7803-9906-4

For updates to this information check out the MTT website at <http://www.mtt.org/> and follow the pointers to the CDROM information. Go to <http://www.ieee.org/> to update your membership or to join IEEE-MTT. 

IEEE Transactions on Intelligent Transportation Systems

Call for Papers

The IEEE Intelligent Transportation Systems Council (ITSC) announces a new transactions journal, the IEEE Transactions on Intelligent Transportation Systems. The first quarterly issue will appear in March 2000.

Improved planning, design, management, and control of future transportation systems requires conducting both basic and applied research to expand the knowledge base on transportation. The new IEEE Transactions on ITS will focus on the design, analysis, and control of information technology as it is applied to transportation systems. Topics to be considered will include, but will not be limited to:

- Sensors (infrastructure & vehicle-based)
- Communications (wide area & vehicle-to-roadside)
- Man-Machine Interfaces (displays, artificial speech)
- Decision Systems (expert systems, intelligent agents)
- Simulation (continuous, discrete, real-time)
- Reliability & Quality Assurance
- Imaging and Image Analysis
- Information Systems (databases, data fusion, security)
- Computers (hardware, software)
- Control (adaptive, fuzzy, cooperative, neuro, large systems)
- Technology Forecasting & Transfer
- Systems (engineering, architecture, evaluation)
- Signal Processing
- Standards.

Transportation systems are usually large-scale in nature and are invariably geographically distributed. The complexity of transportation systems arises from many sources. Transportation

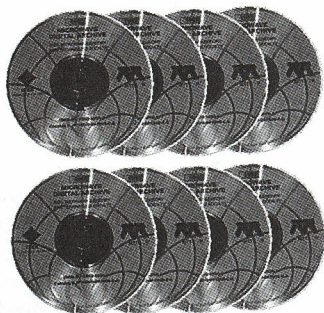
systems can involve humans, vehicles, shipments, information technology, and the physical infrastructure—all interacting in complex ways. Many aspects of transportation systems are uncertain, dynamic and nonlinear, and such systems may be highly sensitive to perturbations. Controls can involve multiple agents that are distributed and hierarchical. Personnel who invariably play critical roles in a transportation system have a diversity of objectives and a wide range of skills and education.

Despite such complexity, the emergence of new technologies—such as sensors, communications, low-cost, faster computation, and new control and optimization algorithms—provides new opportunities to substantially improve efficiency, safety and environmental impact. With the use of these technologies, new and faster measurements are possible and more data can be managed and processed. Additionally, new strategies for management and control will be developed to deal with both the static and the dynamic nature of transportation systems. So, while most of the classical transportation problems raised in the past continue to exist, there now are new approaches with which to contend.

The intent of the IEEE Transactions on ITS will be to serve as a forum for the technological aspects of information technology to transportation, thus providing researchers with an outlet for publication.

For further publication guidelines, contact the editor at ccwiii@umich.edu or by call 734-764-5723. Please send five (5) copies of your manuscript for possible publication to:

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For updates to this information check out the MTT
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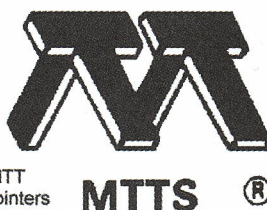
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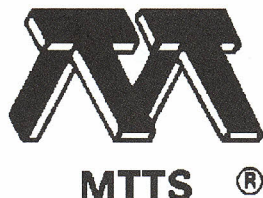
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MTT-3, Technical Committee on Lightwave Technology

Chairman: Dr. Reinhard Knerr
Co-chair: Dr. Peter Herczfeld

<http://www.mtt.org/mtt-3/>

Mission Statement

The Technical Committee on Lightwave Technology consists of experts in the various specialties of this field which are associated with industry, government and academia.

The goals of this committee are: To facilitate the exchange of information about lightwave technology among members of the IEEE Microwave Theory and Techniques Society, and, to assist in educating the MTT-S community on the techniques and applicability of lightwave technology.

These goals will be achieved by organizing and participating in meetings, workshops and Special Issues of the Transactions on Microwave Theory and Techniques which shall assist our members in maintaining the high standards of our profession and attract practitioners from the international community.

The committee emphasizes applications which use MTT-S' core competencies, including:

1. Guided wave techniques, as applied to fiber, optical wave guides, optical components and their associated applications in both the civilian and military field. 2. High speed circuits, microwave techniques and their combination and/or integration with

opto-electronic devices. 3. Device and Systems applications, using those techniques.

MTT-3 cooperates with other MTT-S Technical Committees to assure that MTT Members get the full benefit of their combined expertise,

Recent Events Sponsored By MTT-3

IMS 1997

- *Workshop: Optical Methods for Mobile and Personal Communication Systems*
 Organizers: Prof. Tibor Berceli; Dr. James Plourde

1998-1999 MTT-3 MEMBERS

Name	Phone	Fax	E-mail
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Plourde, James (since 1998)	610-391-2348	610-391-2434	plourde@lucent.com
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Way, Winston (since 1992)	+886.3.572.9138	+886.3.572.3263	wiway@cc.nctu.edu.tw

PAST and PRESENT CHAIRMEN

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Herczfeld, Peter + (1995 - 1997)	215-895-2256	215-895-4968	p.herczfeld@ieee.org
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Yu, Paul	619-534-6180	619-534-2486	yu@ece.ucsd.edu

+ Liaison to MWP

* Liaison to MTT-16

** Liaison to MTT-S ADCOM 10/04/98

- *Workshop: Electro-Optic Modulators for Microwave/Millimeterwave Applications* Organizers: Prof. Dieter Jäger
- *Workshop: Microwave and Millimeterwave Optoelectronic Integrated Circuit Modules: Manufacturing and Applications* Organizers: Prof. Afshin Daryoush; Norman Dietrich; Prof. Paul Yu
- *Workshop: Optical Amplifiers in Microwave Systems* Organizers: Dr. Charles Cox; Francois Deborgies; Dr. Ron Esman; Dr. Hiroyo Ogawa
- *Focused Session: Ultra-Short Optical Pulse Techniques for Millimeterwave Applications* Organizers: Prof. Chi Lee; Dr. Arye Rosen
- *Regular Session: Analog Fiber Optic Link Technology*
- *Regular Session: Microwave Photonic Systems and Components*

IMS 1998:

- *Workshop: Novel Approaches to Photonic Antenna Integration* Organizers: Dr. Charles Cox; Prof. Tatsuo Itoh
- *Workshop: Microwave/Lightwave Methods for Indoor and Outdoor Wireless and Mobile Communications* Organizers: Prof. Tibor Berceli; Prof. Peter Herczfeld; Dr. James Plourde; Prof. Winston Way
- *Workshop: Low Cost digital and Analog OE Modules: Manufacturing and System Insertion* Organizers: Dr. S. Chandrasekar; Prof. Afshin Daryoush; M. Wale; Prof. Paul Yu
- *Focused Session: Optical Beam Forming for Phased Arrays* Organizers: Prof. Alwyn Seeds; Dr. D. Zimmermann
- *Regular Session devices for Microwave Photonic Systems*
- *Regular Session: Photonics for Wireless and Radar Systems*

IMS 1999

- *Workshop: Onboard Active Array Antennas for Communication Systems* Organizers: Dr. Afshin Daryoush; Dr. Hiroyo Ogawa

- *Workshop: High-Resolution Multi-GSPS Analog to Digital Converters* Organizers: Dr. Ron Esman; Prof. Anand Gopinath
- *Workshop: State of the Art of Microwave Photonic Components* Organizers: Francois Deborgies; Dr. Edward Ackerman
- *Focused Session: Opt-Electronic Processing of Microwave Signals* Organizers: Prof. Alwyn Seeds; Klaus Breuer
- *Focused Session: Microwave Applications of Photonic Bandgap (PBG) Materials* Organizers: Prof. Dieter Jäger; Dr. Charles Cox
- *Regular Session: Microwave Photonic Components*
- *Regular Session: Devices for Microwave Photonic Systems*
- *Regular Session: Photonics for Wireless and Radar Systems*

Special Issues of the Transactions on Microwave Theory And Techniques:

Optical-Microwave Systems, Subsystems, and Devices, MTT-38, No. 5, May, 1990. Guest Editors: Prof. Peter Herczfeld

Microwave and Millimeter-Wave Photonics, MTT-43, No. 9, August, 1995. Guest Editors: Prof. Peter Herczfeld, Dr. Hiroyo Ogawa, Dr. Alvaro de Salles, Prof. Alwyn Seeds, and Dr. Rodney Tucker

Microwave and Millimeter-Wave Photonics, MTT-45, No. 8, August, 1997. Guest Editors: Prof. Alwyn Seeds and Dr. Ronald Esman

Microwave and Millimeter-Wave Photonics, MTT-47, No. 7, July, 1999 (Scheduled). Guest Editors: Dr. Ronald Esman And Prof. Ulrik Gliese

International Topical Meeting On Microwave Photonics:

MWP'93: July 19-21, 1993: Red Lion Inn, Santa Barbara, California USA

Co-chairs: D. G. Arjavalingam and Prof. Chi Lee

MWP'94: 1994: Cernay-la-Ville, France
Chair: Dr. Robert Adde

MWP'95: 1995: Keystone; Colorado USA
Co-chairs: Dr. Charles Cox and Prof. Ming Wu

MWP'96: December 3-5, 1996: ; Advanced Telecomm Research Inst., Kyoto Japan Co-chairs: Dr. Tsukasa Yoneyama, Dr. Yoji Furuham, Dr. Masayuki Izutsu

MWP'97: September 3-5, 1997: Schloß Hugenpoet; Duisburg/Essen Germany
Co-chairs: Prof. Dieter Jager, Prof. Alwyn Seeds

MWP'98: October 12 -14, 1998: Sarnoff Research Center; Princeton New Jersey USA Co-chairs: Prof Peter Herczfeld, Prof. Chi Lee

MWP'99: November 16-19, 1999: Rydges Carlton Hotel, Melbourne Australia
Co-chairs: Prof. Dalma Novak, Dr. Hiroyo Ogawa, and Dr. Ronald Esman

MWP'00: September 6-8, 2000: St. John's College, Oxford England Chair: Prof. Alwyn Seeds

MTT-3 is a committee with a dynamic, professional membership. My service as chairman will end with IMS 99. I am sure that my successor, Dr. Alwyn Seeds, who is eminently qualified for the assignment, will continue the honored tradition of MTT-3 and produce outstanding technical events for the benefit of our MTT-S Membership.

Reinhard Knerr



The ARFTG Microwave Measurement Student Fellowship

The Automatic RF Techniques Group (ARFTG) announces a new Microwave Measurement Student Fellowship. The purpose of this fellowship is to recognize and provide financial assistance to graduate students who show promise and interest in pursuing research related to improvement of radio frequency and microwave measurement techniques.

One or more \$7,500 awards may be granted each year, based on available funding and on the number and quality of applications received. The next deadline for applications is April 15, 1999.

Eligibility: Applicants must have a bachelor's degree in engineering, physics, or computer science, and must be enrolled as a full-time student in a graduate degree program at a suitably qualified institution of higher learning. Applicants must be carrying out research as part of the degree program, rather than just taking course work. The proposed research project must clearly involve RF/microwave measurements, and be supervised by a full-time faculty member. The faculty advisor or supervisor must be an ARFTG member, or the proposal must be sponsored by an ARFTG member.

For more information visit our website at www.arftg.org/fellow.html or contact:

Jeffrey Jargon
ARFTG Fellowship Coordinator
NIST 325 Broadway, M/S 813.01
Boulder, CO 80303 USA
Tel: (303)497-3596
Fax: (303)497-3970
E-mail : jargon@boulder.nist.gov



Dear SFV MTT-S Chapter Colleagues,

Since becoming your chairman in June 1996, I have published a year-end summary of our chapters' activities. The 1998 report will show this was a very good year for our chapter. We held nine- (9) technical meetings and hosted three- (3) MTT-S Microwave Distinguished Lecturers. Our chapter members were also very involved with the 1999 International Microwave Symposium and the editing of the historic MTT 18 CD-ROM set being published by the MTT-S in 1999. Clark Bell, Bob Eisenhart, George Oltman, Don Parker, Chuck Swift and Eugene Torgow serve the MTT International Society. I appreciate all the efforts and contributions each of you have made this year to our SFV Section chapter. Our chapter is one of the most active in both the IEEE Los Angeles Council and the Microwave Theory and Techniques Society.

*Best Regards,
Jim Weiler*

Chair, SFV Section MTT-S Chapter

Technical Meetings: (average attendance >40)

1. January 15, 1998
Presentation: "DSP Behind The Front Panel"
Presenter: Byron Edde, Quin Tech Corp.
Location: 94th Aero Squadron in Van Nuys
2. March 17, 1998
Presentation: "Millimeter-wave Packaging and Interconnect"
Presenter: Professor Dr. Wolfgang Menzel, University of Ulm (Germany), MTT-S
Microwave Distinguished Lecturer
Location: The Lakes at El Segundo
Joint Meeting: 7 IEEE Society Chapters, 1 IEEE Section, IEEE LAACN, and IMAPS Angel Chapter
3. March 19, 1998
Presentation: "RF Circuit and System CAE Tools"
Presenter: Paul Draxler, Qualcomm Inc.
Location: 94th Aero Squadron in Van Nuys
4. May 7, 1998
Presentation: "Miniaturization of Microwave Components for Mobile Communications Systems using High Dielectric

Constant, Low Loss, Temperature Stable Ceramic"

Presenter: Dr. Kikuo Wakino, Murata Manufacturing Company Ltd., MTT-S
Microwave Distinguished Lecturer
Location: UCLA Engineering IV

5. May 12, 1998
Presentation: "Microwave Active Filters and Multiplexers: New Solutions to Long-Standing Problems"
Presenter: Dr. Christen Rauscher, Naval Research Laboratory, MTT-S
Microwave Distinguished Lecturer
Location: The Lakes at El Segundo
Joint Meeting: LAC and SFV Section MTT-S Chapters

6. May 21, 1998
Presentation: "GaAs HBT MMICs For Power Amplification In Wireless Systems"
Presenter: Dr. Ken Weller, Rockwell Semiconductor Systems
Location: 94th Aero Squadron in Van Nuys

7. September 17, 1998
Presentation: "Stupid Microwave Oven

Tricks"

Presenter: Dr. Bruce Kendall,
3Com Corp.

Location: C.W. Swift & Associates in
Van Nuys

Joint Meeting: Three (3) local LAC
MTT-S Chapters

8. November 12, 1998

Presentation: "Band Pass Filter Tuning in
the Time Domain"

Presenter: Dr. Joel Dunsmore,
Hewlett-Packard

Location: Signature Grill in
Sherman Oaks

9. December 8, 1998

Presentation: "Research & Development
of the National Space Launch Industry
and its Commercialization, plus Details
on the Linear Aerospike SR-71 Experiment
(LASRE)"

Presenter by Dave Lux, NASA Program
Manager for SR-71

Location: USC (91 people in attendance)

Joint IEEE Meeting: 11 Society Chapters,
1 Section, & USC Student Branch
SFV Section MTT-S Chapter AdCom
"Board" Meetings:

1. March 2, 1998, @ C.W. Swift &
Associates

2. April 27, 1998, @ C.W. Swift &
Associates

3. July 30, 1998 @ Signature Grill

4. October 5, 1998, @ C.W. Swift &
Associates

5. October 26, 1998, @ C.W. Swift &
Associates

6. December 7, 1998, @ Islands

Other Meetings: (Our chapter member, Dr.
Bob Eisenhart, is Chair of the 99/IMS,
therefore, these meetings show our mem-
bers are actively supporting IEEE and
MTT-S in a bigger picture.)

1. January 29, 1998, DWP, Los Angeles,
Weiler-Dalton Meeting Concerning Elec-
tronic Photos of Professor Menzel and Dr.
Rauscher & LAC Chapter Activities and
Support

2. February 2-4, 1998, The Waterfront
Hilton Beach Resort, Huntington Beach,
Electronic Components For The Commer-
cialization of Military and Space Systems

International Workshop, Jim Weiler con-
structed and manned IEEE recruiting
booth and chaired a technical session.

3. March 26, 1998, The Proud Bird Res-
taurant, Los Angeles, 1999 International
Microwave Symposium Steering Commit-
tee Meeting

4. April 20, 1998, ECI Office Building,
Los Angeles, LAC Wescon Chapters
Meeting (SFV MTT-S Chapter has not re-
ceived their WESCON registration kick-
back yet. Jim Weiler in attendance.)

5. May 16, 1998 CSU Fullerton, Region 6
Southern Area Meeting (Curtis Barrett at-
tended, \$250 given to SFV MTT-S Chap-
ter for Support)

6. May 28, 1998, Hyatt, Anaheim, 1999
International Microwave Symposium
Steering Committee Meeting

7. June 9, 1998, MTT-S Annual Chapter
Chairman's Meeting, Baltimore, MD
(Clark Bell attended)

8. June 7-12, 1998, Baltimore, MD, Joint
1999 International Microwave Sympo-
sium Steering Committee Meeting with
1998 IMS Steering Committee

9. June 17, 1998, Los Angeles,
Weiler-Dalton Lunch Meeting Concerning
LAC Chapter Activities and Support

10. July 23, 1998, The Proud Bird Restau-
rant, Los Angeles, 1999 International Mi-
crowave Symposium Steering Committee
Meeting

11. September 10, 1998, Les Freres Taix
Restaurant, Los Angeles, 1999 Interna-
tional Microwave Symposium Steering
Committee Meeting

12. September 15-17, Anaheim,
WESCON

13. October 17, 1998, Cal Poly SLO, Re-
gion 6 Southern Area Meeting (Curtis
Barrett and Clark Bell in attendance)

14. November 19, 1998, West Coast Ana-
heim Hotel, Anaheim, 1999 International
Microwave Symposium Steering Commit-
tee Meeting

1999 International Microwave Symposium:

The following members of the SFV Sec-
tion MTT-S Chapter are members of the
Steering Committee for this symposium,

which is expecting an international
attendance in Anaheim June 12-19, 1999
exceeding 10,200.

General Chairman:
Dr. Robert L. Eisenhart

Publicity: Steve Swift

Digest: Mehran Matloubian

Transactions Guest Editor:
Dr. Dave Rutledge

Registration: Phil Arnold, Jim Weiler,
Harvey Olifson

Special Exhibits: Dr. H. Clark Bell,
Harvey Endler

Chief of Protocol: Nancy Eisenhart

Others: Ron Midwin, George Oltman,
Carolyn Parker, Don Parker, Chuck Swift

1998 SFV Section MTT-S Chapter Ad-
ministration Steering Committee:

Chair: Jim Weiler, JPL/ACRO Service
Corp.

Vice-Chair: Clark Bell, HF Plus

Secretary: Curtis Barrett, SQ3R Con-
sulting

Treasurer: Harvey Endler, JPL

Webmaster: Harvey Olifson, M&O

Newsletter: Phil Arnold, HP

Member @ Large: Steve Swift, C.W.
Swift & Associates

1999 Officer Election Results:

The IEEE SFV Section MTT-S Chapter
held their elections for 1999 officers at
their technical meeting November 12,
1998. The results are as follows:

Term of Office Begins: January 1999

Term of Office Ends: December 1999

Chair: James C. Weiler, Jr.
07455082
(626) 795-4928 x222
j.c.weiler@ieee.org
Member

Vice-Chair: H. Clark Bell
05654900
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Fellow

Secretary: Curtis W. Barrett
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Member

Treasurer: Harvey Endler
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harvey.endler@
jpl.nasa.gov
Life Senior Member

Professional Activities:
Philip Arnold
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phil_arnold@hp.com
Member

Publicity Chair: Harvey Olifson
05363494
(818) 996-9093
h.olifson@ieee.org
Senior Member

All officers, at the time of election or appointment, were Member grade or above, have current IEEE and Chapter Society dues paid and are members of the San Fernando Valley Section.

Chapter Membership:

Woodland Hills	22	Acton	2
Glendale	18	Burbank	2
Van Nuys	16	Encino	2
Northridge	14	Mission Hills	2
West Hills	12	Simi Valley	2
Agoura/ Agoura Hills	11	Sylmar	2
Lancaster/ Palmdale	11	Bell Canyon	1
Tarzana	10	Camarillo	1
Chatsworth	7	La Canada Flintridge	1
Calabasis	7	Lake Hughes	1
Canoga Park	6	Los Angeles	1
Granada Hills	6	Marina Del Rey	1
Sherman Oaks	6	Oak Park	1
Valencia	5	Rosemead	1
Reseda	4	Sun Valley	1

Chapter WebPage:
"http://www.mo-rep.com/sfvmmt.htm"

Financial Information:

The chapter and its members really have to dedicate a lot of effort to funding our technical meetings. Our meals at the 94th Aero Squadron cost us \$22.50 each, we had a required minimum of 20 and we needed a sponsor to purchase a minimum of four (4) bottles of wine. We collected \$15 from each of our dinner attendees. Our annual September barbecue is free for all attendees and we must buy all the food and rent tables, chairs, and the screen. The chapter publishes a meeting announcement for each of our technical meetings in the San Fernando Valley and circulates it to approximately 700 individuals. There were five (5) presentations from out-of-town individuals who required transportation and room expenses. We could not provide a technical program for the educational and professional benefit of our community without the support of the IEEE and our chapter sponsors.

Past president of the MTT Society and SFV MTT-S Chapter member, George Oltman, was able to convince the MTT-S treasurer to cover both the transportation and lodging expenses for two-(2) of our three (3) MTT-S Microwave Distinguished Lecturers. MTT-S paid for Dr. Clark Bell's trip to Baltimore to present our SFV Chapter Chairman's report. The Los Angeles Council gave each chapter a one-time \$250 support check and the IEEE provided their yearly \$150 stipend through the SFV Section for our 1997 reporting. The LAC MTT-S chapter treasury was used for our March 17 and May 12 meetings. Dr. Itoh took care of all of Dr. Wakino's needs May 7th. The chapter may receive additional support from MTT-S and WESCON before the end of December. Your IEEE dues provided a major portion of our chapter's big-ticket items this year.

The chapter sponsors pay for our meeting, mailings, web page, speaker gifts and other expenses. In the cases of Qualcomm and Hewlett Packard, the presenter's company paid for their transportation and lodging (Paul Draxler and Joel Dunsmore respectively). The 1998 IEEE Region 6 Large Company of the Year Award Winner was Hewlett Packard in recognition of

their support to both the local LAC Antennas & Propagation and SFV MTT-S chapters. The SFV MTT-S Chapter did pay the travel and lodging expenses for our September speaker, Dr. Bruce Kendall. Therefore we would like to recognize the following contributors in 1998 who supported our chapter and the professional development of their local SFV microwave community financially: Hytech Associates, Penstock/Avnet, L&M Engineering, McDougall McGlauflin, Dura Electronic Sales, MCA Repco, Midwin & Olifson, Youngewith and Olnek, C.W. Swift and Associates, Cain Technology/Teledyne, TRW Space & Defense and Hewlett Packard. The chapter may receive additional support from both Applied Wave Research, Hewlett Packard and S&S Technology before the end of December. Please let all our sponsors know you appreciate their philanthropic support of our SFV MTT-S chapter when you work with or see them.

Support to Other LAC Entities:

The SFV Section MTT-S Chapter makes a significant attempt to bolster and support many IEEE entities throughout the LAC and across the State of California. We coordinated both the Professor Menzel and Dr. Rauscher visits with all five (5) California MTT-S chapters. Jim Weiler served the LAC Components Packaging & Manufacturing Technology Society chapter as their chairman in January and helped plan many meetings with the LAC Computer and LAC Reliability chapters. Jim worked with both the IMAPS Angel and Tri-Valley chapters. Curtis Barrett and Clark Bell actively worked to promote the IEEE Los Angeles Area Consultants' Network. Steve Swift participated in the LAC MTT-S chapter technical and planning meetings and the annual Los Angeles Metropolitan Section Aerospace & Electronic Systems chapter conference. Finally, by holding joint meetings, we had a chance to interface with individuals with common interests, the meetings also allowed struggling IEEE and IMAPS chapters to meet their yearly minimum meeting requirements and remain active chapters.

Thanks for Assistance:

Professor Tatsuo Itoh, Honorary Life Member and a past president of MTT-S,

convinced Professor Menzel to embark on his Canada/USA Lecture trip and made the arrangements for his hotel and day at UCLA. Dr. Itoh also worked out all the logistical and location details for Dr. Wakino's presentation at UCLA.

Dr. Charlie Jackson has been very supportive as our assigned MTT-S AdCom Liaison officer. Dr. Hector J. De Los Santos MTT-S Directory and Ed Niehenke MTT Ombudsman have continued their strong support for our chapter when requested.

Members of the LAC Interim Management Council, Dr. Ray Findlay, John Damonte, Celcelia Jankowski and Kip Haggerty specifically were very helpful in resolving many long term interface problems the SFV Section MTT-S Chapter had with various IEEE entities.

The IEEE staff members in Piscataway, New Jersey have provided our chapter with excellent support when called upon. We have worked administrative and legal, member recruiting, IEEE store, WEB page links, email alias, MajorDomo Mailing List and other issues with IEEE headquarters this year.

My fellow local MTT-S chapter chairs, Jim Verkade (LAC) and Bela Szendrenyi (Foothill) who have coordinated their chapters efforts and membership in all our joint meetings. We have also worked to-

gether in cutting IEEE red tape in making each of our chapters more able to support the professional development of their respective members.

Dr. Peter Asbeck arranged to host Professor Menzel at UCSD and Jon Roussos (Chair, San Diego MTT-S Chapter) for both Dr. Menzel and Dr. Rauscher arranged hotel, travel and presentation during the San Diego portion of their trips.

The Santa Clara Valley MTT-S Chapter, Larry Burns (Chair), convinced Dr. Rauscher to come to California and coordinated transportation and lodging for both Dr. Menzel and Dr. Rauscher in San Jose/Santa Clara.

Former SFV MTT-S chapter chair-Dr. Asad Madni was awarded "Fellow of the IEEE" this year.

Looking to 1999:

Membership Advantage: Everyone who is a member of MTT-S during the first half of 1999 will receive an opportunity to purchase the 18 CD-ROM set containing all the MTT-S Transactions, IMS Digests and MTT-S Newsletters from the first publications to present for only \$50. MTT-S is also offering a "Life Time Membership" in 1999 for \$40 if IEEE membership dues are renewed each year. 1999 is the year to be a member of MTT-S.

January 10: LAX Marriott MTT International Society TPC and AdCom meetings, 99/IMS Meeting & Paper Selection

January 12: Technical Meeting, Topic: TBD (check web page, planned presenter will not be here), Signature Grill, Joint with LAC & Foothill MTT-S and LAC Engineering in Medicine & Biology Chapters

February 1: SFV MTT-S AdCom "Board" Meeting, C. W. Swift & Associates

March 1999: Joint Meeting with Foothill Section AP/MTT-S Chapter, Maury Microwave

April 5: SFV MTT-S AdCom "Board" Meeting, C. W. Swift & Associates

May 20: SFV MTT-S Chapter Technical Meeting, Signature Grill

June 13-19: 1999 IEEE MTT-S International Microwave Symposium, Anaheim

September 16: Annual Los Angeles MTT-S BBQ, C. W. Swift & Associates

November 18: SFV MTT-S Chapter Technical Meeting

December 31: Jim Weiler's last day as your chapter chairman! 

From Region 8

By Jozef Modelski MTT-S Transnational Committee Region 8 Coordinator

The Region 8 with 32 MTT Chapters and about 2400 members (quarter of the total MTT membership) is the biggest and the fastest growing region for MTT membership and the number of different events. One of the „keys" of this success is MTT/ED Initiative for Aiding Eastern Europe and Former Soviet Union (since 1994).

The Chapters in Region 8 have increased their activities during 1998 and their mixture of technical meetings, workshops and conferences offer something for all members, whether they work in industry, acade-

mia or government. In 1998 they have organized, supported or sponsored:

- over 40 local or regional conferences, workshops and schools (twelve ones have been financially supported from the Transnational Committee budget);
- over 250 technical meetings and lectures.

Some of the local national conferences have become well known ones playing important role as international regional events, for example: biennial conferences like MIOP (Germany), MIKON (Poland), TELSIKS (Yugoslavia), ICARSM (Russia) or MMET (Ukraine) as well as annual events such as the French National Confer-

ence, CRIMIKO (Ukraine) or the International Travelling Summer School on Microwaves and Lightwaves (Germany, Italy, Poland, Czech R. and Slovakia).

The most important conference for all MTT members in Region 8 is annual European Microwave Conference (EuMC) which has recently been transformed in European Microwave Week (EuMW). The first EuMW was held in Amsterdam, 5-9 October 1998 and has become the most significant microwave event in Europe. An essential task was to set up strong links with the microwave and wireless industry. The strength of the EuMW-98 was enhanced by hosting three conferences within one week covering the full range of

microwaves and radio frequency activities from components, devices, systems and networks up to applications. On behalf of the Transnational Committee and myself I would like to congratulate once more Prof. Leo Ligthart, Chairman of the EuMW-98 and all Members of the EuMC Steering Committee. It is a great success and I wish you to keep this "line".

For five years, one of the most important activity in Region 8 has been IEEE MTT/ED Initiative for Aiding Eastern Europe and the Former Soviet Union (EE/FSU) with two phases:

- Phase I – Membership Promotion and Chapter Formation (1993-1996),
- Phase II – Consolidation and Further Expansion of Chapters (since September 1996).

Summary of this very successful initiative is given in the next point.

This year the annual Region 8 Chapter Chairpersons Meeting was integrated with other Societies as the 3rd annual joint Division I and Division IV Region 8 Chapters Meeting. It was very well attended by representatives of twenty eight MTT Chapters on October 4 in Amsterdam, in conjunction with the European Microwave Week. A brief report of it is presented in the following section.

During MTT AdCom Meeting in January in Los Angeles, I took the job as a 1999 MTT Region 8 Coordinator. At the steering body of Region 8 I have also two good friends Prof. Robert Weigel from the Technical University of Linz (Austria) and Prof. Zbynek Skvor from the Technical University of Prague (Czech Rep.). This year Robert will concentrate on formation of the new chapters in Western Europe (we are seeing such opportunities in Austria, Denmark, Norway) but Zbynek on Southern Europe and Middle East (Romania, Croatia, Iran, Saudi Arabia). According to us, the local chapter activities are the most important key to membership growth, improvement of society image and realization of globalization process (policy). I would like to welcome Robert and Zbynek on "board" and wish success and satisfaction for the coming activities in Region 8.

The main activities and events planned in 1999 are:

- stimulation and support of the local chapters activities,
- continuation of Phase II of the Initiative for Aiding EE/FSU – "Consolidation and expansion of the new Chapters",
- formation of new chapters,
- European Microwave Week EuMW-99, October 4-8, Munich, Germany,
- the 4th annual Divisions I & IV Region 8 Chapters Meeting, 12 September, Leuven, Belgium, in conjunction with ESSDERC,
- annual Region 8 MTT Chapter Chairmen Meeting, 6 October, Munich, in conjunction with the EuMW-99.

Summary of the Divisions I and IV Region 8 Chapters Meeting

The third annual joint Divisions I & IV Region 8 Chapters Meeting was held on Sunday, 4 October 1998 in Amsterdam, in conjunction with the European Microwave Week (EuMW-98). This Meeting grew out of MTT/ED Initiative – the first one was held in Prague on 8 September 1996 in conjunction with the European Microwave Conference (EuMC-96) and the second one in Ludwigsburg (near Stuttgart) on 21 September 1997, in conjunction with the European Solid State Device Research Conference (ESSDERC-97).

This year meeting was an all day event and was attended by 78 representatives (in 1996 – 50, in 1997 – 52 ones, respectively) from 9 Societies and 50 Chapters, from the 30 countries in Region 8. Of the 32 MTT Chapters in Region 8, 28 participated in the meeting.

The IEEE division-level meeting was an example of how to have various IEEE entities (divisions, societies, regions, sections and chapters) share ideas and work together to improve activities and services for IEEE members. The meeting featured a series of presentations from the two division directors, the Region 8 past director, society presidents and representatives, two workshops, and reports from chapters. The chapter reports highlighted best practices as well as problems facing the chapters. The main

themes of the day were the dual-parent (section versus society) system for chapters and the globalization of the IEEE.

A panel discussion on the globalization of IEEE posed the questions, „is IEEE perceived as a global organization?“ and „should IEEE be globalized?“. The wide-ranging discussion touched on a number of topics, including the feasibility of establishing an IEEE-Europe and the question of whether IEEE-USA is an obstacle in the globalization process.

The afternoon session was divided into a workshop on membership development and presentations by chapter representatives. The "4 Rs" (recruitment, retention, recovery, recognition) and "4 Is" (information, identification, innovation, implementation) in relation to membership development were introduced.

1998 Divisions I & IV Region 8 Chapters Meeting proved to be very successful with regards to learning and understanding the needs of the chapters and determining appropriate solutions. It also served as a unique forum for Region 8 Chapter Chairs with diverse technical backgrounds to meet with one another, exchange information and ideas as well as to discuss, learn and start to realize the IEEE globalization process (policy).

This meeting was excellent logistically prepared and organized by Bill Van Der Vort, ED-S Executive Director and Kees Van't Klooster, MTT/AP Benelux Chapter Chair. MTT-S was represented by 1998 MTT President Roger Pollard, Past Co-chairman of TC Rolf Jansen, and myself.

The fourth Divisions I & IV Region 8 Chapters Meeting will be held in Leuven (Belgium) on 12 September 1999, in parallel with the ESSDERC.

State-of-Art of Phase II of the Joint MTT/ED Initiative for Aiding EE/FSU

The Joint MTT/ED Initiative for Aiding Eastern Europe and the Former Soviet Union (EE/FSU) started in 1993 when MTT-S Transnational Committee established an Ad Hoc Committee (for aiding EE/FSU) with Rolf Jansen as its chair. The first ideas for the initiative were generated as a result of the end of the „cold war“. It

needed an organizational effort to get in contact with engineers, especially those in the FSU area, identify their interest, help to form membership and Chapters. So that these members of the electrical engineering community could participate in the worldwide exchange of technical information, which is a natural feature of IEEE.

I was a chairman of the Polish Chapter at that moment and had good relations and contacts with many individuals in FSU countries. Working together with Ari Sihvola (from Finland) in the Ad Hoc Committee and having great support and help from Rolf Jansen and Bill Van Der Vort (ED-S Executive Director) we started to go through learning phases, organizational difficulties, cultural experiences, etc.. However, it was all a lot of fun, particularly the pleasant cooperation with very enthusiastic organizers of the new chapters in selected areas.

Phase I of the MTT/ED Initiative "Membership promotion and Chapter formation" was achieved with the first Divisions I & IV Region 8 Chapters Meeting in September 1996 at Prague. By that moment 12 new MTT/ED (or MTT/ED/AP) Chapters were formed: St. Petersburg (April 1995), Saratov-Penza (July 1995), Moscow (April 1995), Nizhny Novgorod (March 1996), Novosibirsk (May 1996), West Ukraine-Lviv (January 1995), East Ukraine-Kharkov (April 1996), Central Ukraine-Kiev (May 1996), Lithuania (May 1995), Bulgaria (June 1995), Belarus (May 1996) and Republic of Georgia (March 1997).

In conjunction with the completion of Phase I of our initiative, Rolf Jansen has

stepped down from his job and since September 1996 I have been leading Phase II "Consolidation and further expansion of Chapters".

Its purposes (consolidation, expansion) have been realizing by:

- providing Eastern European Library Program and greater Society support to the chapters,
- supporting local workshops and conferences (each year about 10 – 12 events are financially supported from the TC budget),
- supporting student membership (establishing of the student branches, arranging free conference attendance for students and young scientists, etc.),
- providing training for chapter representatives,
- improving communication among Region 8 chapters as well as between chapters and society representatives,
- prompting electronic communication and improving services,
- creating cooperation between the new Chapters and older Western European Chapters (e.g. joint workshops, etc).

In providing the training for chapter representatives and improving cooperation, the two activities were especially important and productive:

- annual Divisions I & Region 8 Chapters meetings,
- personal visits of the chapters representatives to my Institute in Warsaw and to

the MIKON Conference which is identified and favoured as one of the possible focus points for interaction with the existing and future membership in the EE/FSU area.

After two years realization of the Phase II, we can notice few important results:

- two times increase in total membership,
- higher percentage of the young generation (even student branches have been started to establish in few areas, e.g. Novosibirsk, Kharkov);
- very well prepared and organized conferences and workshops with English (as an official language) and professionally edited proceedings (which results also in high number of foreign attendees);
- huge number of regular technical meetings, lectures and other activities;
- hope that all new chapters will survive and have good perspectives.

The great success of this initiative and the tremendous response from the members in FSU and from many levels of the IEEE officers, would not have been possible without the hard work of the chairpersons, like Sergei Malyshev, Alex Nosich, Nikolai Voitovich, Boris Kapilevich, Vladimir Lioubtchenko, Sergei Tretaykov, Yuri Belov, Yuri Poplavko, Boris Levitas and Michael Davidovich. I would like to express my deep thanks and gratitude to all of you for your constructive ideas, time and energy. It is a pleasure to work with you on this project.

June 17, 1998

MISSION STATEMENT-MTT-8

Almost all physical devices can be represented by some equivalent network. It is the mission of the MTT-8 Filters and Multiplexers Technical Committee to provide expert consideration for new developments in the synthesis and analysis of passive and active elements so interconnected as to achieve a specified transfer function in the specified response domain. Considerations include review of papers submitted to publications, providing member contributions to technical publications, books, and MTT-Newsletters, preparation of standards, presentation of Workshops, editing for Special Issues, maintenance of an information website and other activities as assigned by the Chairperson of the MTT TCC.

COMMITTEE MEMBERS (as of 6/12/98)

1	2	3	4	5	6	7
COMMITTEE MEMBER (YEARS) (A/I)	ORGANIZATION/ ADDRESS	CITY	STATE/ZIP	E-MAIL	TELEPHONE	FAX #
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Chapter Records Around the World

By Héctor J. De Los Santos

Dear MTT Chapter volunteers, greetings and best wishes in the New Year! It is a pleasure to acknowledge your outstanding response to our request for providing regular submissions of your Chapters' activities. As suggested previously, electronic sub-

missions are preferred and we will be glad to provide you with an electronic version of IEEE form L-31. I want to take this opportunity to thank Dr. Shyam Bajpai, MTT-S Chapter News, for his interaction with the Indian Chapter, which resulted in the submission of a timely report. To help you plan your timely future submissions, please be

informed that the deadlines for inputs to all of the IEEE MTT-S Newsletter issues are one month after an AdCom Meeting or Mid February, Mid July, and Mid October.

Thanks for your efforts. Your reports should be e-mailed to: hjdlossantos@mail.hac.com. Hope to hear from you soon!

New Chapter Officers

Cleveland (ED/MTT/LEO): George Ponchak, Chair

Florida West Coast(MTT/AP/ED): Gregory M. Bonaguide, Chair; Tom Weller, Vice-Chair

France(MTT/ED): Daniel Pasquet, Chair; Christian Rumelhard, Vice-Chair

Poland(AP/MTT/AES): Edward Sedek, Chair; Michal Mrozowski, Vice-Chair

Santa Clara Valley/San Francisco (MTT): Edmar Camargo

Sao Paolo (MTT): Hugo Hernandez Figueroa, Chair; Denise Consoni, Vice-Chair

South Africa (MTT/AP): Johan Joubert, Chair; Wimpie Odendaal, Vice-Chair

Switzerland (MTT/AP): Rüdiger Vahldieck, Chair; Pascal Leuchtmann, Vice-Chair

West Ukraine(MTT/ED/AP): Nikolai N. Voitovich, Chair; Evgen M. Yashchyshyn, Vice-Chair

Washington / Northern Virginia USA (MTT): Roger Kaul, Chair; John Margosian, Vice-Chair

Chapter Activities Summary

❖ **Atlanta:** Dr. Joy Laskar, Chair; Mary Lynn Smith, Vice-Chair; Rickey Cotton, Program Chair.

(1) Dr. Gailon Brehm (TriQuint Semiconductor), "MMICs for Wireless Communications-Design and Technology Tradeoffs." Date: 10/6/98; Attendance: 37. (2) Dr. Douglas Teeter (Raytheon Corp.), "Practical Considerations for Developing High-Efficiency Power Amplifiers." Date: 11/5/98; Attendance: 25. (3) Dr. Ramachandra Panicker (Micro Substrates Corp.), "Development of RF BGA Technology." Date: 11/11/98; Attendance: 20.

❖ **Central and South Italy:** Bernardi Paolo, Chair; Pisa Stefano, Vice-Chair

I. Technical Meetings

(1) Dr. Mario Topi, "Theory, design techniques and structures of microwave filters and their application on airborne and ship-board microwave systems." Date: 5/6/98.

(2) Dr. Felice Russo, "Evolution of DRAM Technology." Date: 5/7/98. (3) Dr. Felice Russo, "Floating gate flash memory overview." Date: 6/2/98. (4) Dr. Antonio Scatamacchia, "Microwave ibrid circuits." Date: 3/26/98. (5) Dr. Marcello Zolesi, "Computer aided Microwave circuit design (HFSS and STRATA)." Date: 5/28/98.

II. Membership Evolution During the Last 3 Years

1996 85 member

1997 118 member

1998 201 member

❖ **Columbus:** Prof. Joel Johnson, Chair; Dr. Brian Baertlein, Vice-Chair; Steven W. Ellingson, Sec./Treasurer.

(1) (Prof. H.-J. Li (National Taiwan University), "Channel Characteristics Research at National Taiwan University." Date: 6/29/98; Attendance: 14. (2) Dr. George I. Zysman (Lucent Technologie), "Future Wireless Technologies." Date: 11/6/98; Attendance: 45. (3) Dr. Harry L. Bertoni (Polytechnic University of Brooklyn), "Site Specific Propagation Prediction for Wireless Applications." Date: 11/12/98; Attendance: 22.

❖ **Egypt:** Prof. Ibrahim A. Salem, Chair

Our MTT/EDS joint chapter-Egypt section was established year 1994 with 32 MTT members. This year the total MTT members are 77 including student members. The chapter - in cooperation with the URSI National committee - holds a yearly conference including commission B (Fields and Waves). The 16th National Radio Science conference, '99 will be held on 23-25 Feb., '99 at Ain-Shams University - Cairo - Egypt.

❖ **Florida West Coast:** Gregory M. Bonaguide, Chair; Dr. Tom Weller, Vice-Chair

(1) Mr. Matt Smith (Raytheon Systems Co.), "Comparison of Solid State, MPM, and TWT-based Transmitters for Spaceborn Applications." Date: 9/15/98; Attendance: 18. (2) Dr. Christos Christodoulou (Univ. of Central Florida), "Neural Network Modeling in Microwave Antenna Design." Date: 10/20/98; Attendance: 15. (3) Dr. Larry Dunleavy (Univ. of South Florida), "Characterization and Applications of On-Wafer Diode Noise Sources." Date: 11/10/98; Attendance: 11.

(4) Dr. Roger B. Marks (NIST), "Broadband Wireless Access Standards." Date: 1/20/99; Attendance: 25.

❖ **India:** Dr. K.S.Chari, Chair

I. Chapter report for the period Jan-March 1998

Beginning the new year, the Chapter had taken initiatives in starting the IEEE STAR programme in India for the first time and supporting the young faculty in organising local technical workshops. These efforts have lead to the following:

- The Chapter team consisting the Chapter Chair and Chapter STAR coordinator Prof Devi Chadha from IIT Delhi visited few promising schools that showed active interest to participate in the IEEE STAR programme. Both these members have given expositions at the visted schools on the nature of the STAR activities and the benefits accruing the institutions and the participating students. The interactions have brought out overwhelming response and finally 2 higher secondary schools based in Delhi viz Ahlcon Public School, Mayur Vihar and Delhi Public School, Vasant Kunj were selected. A total of 28 girl students have opted for STAR exposure. Two school staff members Ms Archana Deepak from Ahlcon Public School and Ms Jyoti Gupta from Delhi Public School volunteered to be STAR coordinators at the respective schools. A full year programme involving many technical events were drawn out and the first event of the STAR was held on 15th Jan 98. In this event, the students interacted with their peers in the Engineering and Technology disciplines and visited the various laboratoreslike Lasers, Multimedia, Robtics etc at IIT. The IIT Delhi Professors Prof SRK Iyengar from Mathematics Department, Prof Bharathi Bhat and Prof BD Nagchoudhury from Electrical Engineering and Prof Anshul Kumar from Dept of Computer Science and Engg., have addressed the student gathering and answered several career related issues. The event ended with excitement to the students. EDS has extended the Chapter funding under the STAR activity and support from MTT is awaited.

- Two local workshops viz i) Current trends in Communication and ii) Microwaves and Photonics were organised by the Chapter in collaboration with Forum for Microwaves at Delhi University and IEEE India Council ASCOM-LEO Chapter. These events were held during March 2-3 and March 4, 1998 respectively. Prof Enakshi Sharma and Prof AK Verma of Delhi University coordinated the first activity and Prof Lakshmi Gupta again of Delhi University coordinated the second activity. These workshops were financially also supported by the Department of Electronics, Govt of India substantially. About 100 participants have attended each of these workshops. The workshops have highlighted the trends in the ED/MTT areas in these fields.

II. Chapter Report for the Period of April - June, 1998

In the quarter April - June, 98, the Chapter related to efforts on the newly initiated IEEE STAR Programme, new membership drive and working out schedules for the local/DL workshops in the later half of the year.

Under the IEEE STAR Programme, two events were held to expose the selected higher secondary school girl students to the issues in the area. The first event was around the IEEE Video Show on "Careers on Electrical Engineers and Computer Scientists" and a half-an-hour slide show on "What is an Engineer" held on 11th May, 98. Chapter Chair presented the slide show to the audience. The second event was a visit to the cyber school housed in the National Science Centre, New Delhi wherein the students had an hands-on experience on "Internet links and Multi-Media Educational Material especially on Science and Engineering". About 30 students attended these exposures and enjoyed these interactions. These exposures have lead to further demand from the participants to such increased exposures in different facets of science and engineering. Chapter Chair co-ordinated the activities alongwith Ms. Archana Deepak of the Alhons Public School, Delhi

2. A Seminar-cum-Workshop on "Conformal Antennas and Related device

technologies" was held at the Department of Electronic Science, Berhampur University, Orissa during 23rd to 25th May, 1998. Dr. R K Mishra of Department of Electronic Science co-ordinated the event. The workshop was attended by several academic and research participants with outside experts delivering the lead talks.

3. The Chapter had one executive meeting on 4th April, 98 and reviewed the membership drive and the seminars/ workshops planned for rest of the year. It was decided to bring more awareness at the University campuses on the reductions of the IEEE Membership subscriptions for the student members so that more participations from this segment could be obtained. The chapter also discussed ways of extending further subsidy to quicken this interest. Several topics for technical events were identified.

♦ Los Angeles: James Verkade, Chair

(1) Dr. Bruce Kendall (3Com), "Stupid Microwave Oven Tricks." Date: 9/17/98. (2) Dr. Hector J. De Los Santos (Hughes Space and Communications Company), "MEMS in Wireless Communications." Date: 10/27/98. (3) Dave Lux (NASA), "National Space Launch Industry." Date: 12/08/98. (4) Dr. Martin Herman (JPL), "Pluto probe." Date: 01/12/99; Attendance: (5) Mark Saffian (Ansoft Corp.), "Advances in High Frequency Circuit Simulation Techniques." Date: 2/9/99.

♦ Nanjing: W. X. Zhang, Chair; Z. Y. Hu, Vice-Chair

Nanjing chapter performed a flourished schedule of technical activities in 1998, total 43 items technical activities had been organized at Nanjing and Shanghai, besides a Chapter Members Meeting and Chapter Trip for National Natual Park.

Thirty-seven lectures including Dr. K. Wakino's distinguished lecture, Prof. Y. Leviatan's special invited lectures, Dr. Kim's tutorial lecture, and Prof. Z. G. Wang's MMIC lectures; four technical visits to advanced systems of radars, communications, Antenna Manufacturing, and microwave medical equipments; two National Symposia; and an open workshop were organized or co-organized. As compared with the contents of technical activities in previous years, they are more close to engineering and industrials.

Some most interested topics attracted many attendance, such as: the lectures on "Miniaturization of Microwave Components for Mobile Communications Systems" (by K. Wakino as DL), "Microwave / Millimeter-wave MMICs Design" (by Z. G. Wang), "Experimental Study on Solid-State Active Monopulse Phased Array antennas" (by B. F. He), "Design of Space-Feed Phased Array Antenna" (by M. C. Hu); and the Visits to "Antennas of Modern Surveillance Radars" and "Advanced Electronic & Microwave Medical Equipments".

Some highlighted topics won high appreciation from the attendance, such as the lectures on "Wavelets in Electromagnetics: The Impedance Matrix Compression Method" (by Y. Leviatan), "Engineering Applications of Oceanic Electromagnetics" (by G. Q. Liang), "A Theory of Broadband Patch antenna" (by Y. L. Chow), "Genetic algorithm Applications to Microwave Engineering" (by J. Qian), "MMW/Sub-MMW Superconductor SIS Mixers Techniques" (by S. C. Shi), and "Anechoic Tile for Submarine" (by T. Y. An).

Some engineering development topics and review presentations also enlivened the exchanging, such as the Lectures on "Satellite and Ground Antennas for Satellite Mobile Communications" (by Z. Q. Gong), "Microwave Ferrite Phase-Shifters and Application to MMIC" (by X. Y. She), "Research Progress on Adaptive Phased Array Antennas" (by Y. C. Guo), "Software Radio" (by F.H.Lin), and "Progress in Antennas & Electromagnetics" (by W. X. Zhang); etc.

The accumulated amount of attendance in above separated technical activities was over 1500 (persons x times), including a high percentage of young engineers and students.

Besides, two co-organized Symposia entitled as "Nat. Symp. on Antenna & EMC Measurements" (2 days, Shanghai) and "Nat. Symp. On Electromagnetic compatibility" (3 days, Nanjing) were successfully held in sequence. The former had 47 attendance, 25 presentations, and a 123 pages Proceedings published (in Chinese); the latter had 70 attendance, 43 presentations, and a 219 pages Proceedings published (in Chinese). Another "Workshop on Microwave Oven Technology" was organized as a consulting service

opened to the society, it won the appreciation in the reports of various media (local newspapers, TV and radio broadcasting).

In addition to the technical meetings and visits, a Chapter Members Meeting was held at a natural scenic spot (Tiemo-Lake Park) joined with a sightseeing & dinner program, some 50 members flocked together from Nanjing and Shanghai areas 300 km apart. The membership renewal and development service program for managing the Money exchange and remittance was run again. The number of Chapter members was increased from 88 to 95 in 1998. Two issues of biannual Chapter Newsletter (No.7 & 8) were published (in Chinese). A biennial nomination-voting procedure for Chapter Chair and Vice-Chairs was completed according to the Chapter By-laws. A new Executive Committee of Chapter is going on since January 1999.

❖ **New South Wales:** Dr. Trevor Bird, Chair; Carol Wilson, Vice-Chair; Dr Karu Esselle, Secretary/Treasurer

I. Membership

As of October 1998, there are 99 members of the AP and MTT Societies in New South Wales. There are four Fellows and 14 Senior Members.

II. Newsletters

Two newsletters were prepared in August and October and distributed to all IEEE AP/MTT members in New South Wales.

III. Meetings

Two meetings were held in 1998.

(1) 'Future Antenna Needs for Radio Astronomy', Dr G.L. James - 27 August

This presentation by Graeme James, CSIRO Telecommunications & Industrial Physics, Marsfield, was given at a joint meeting of the Electrical Engineering Institution at Eagle House, North Sydney. The talk had two main themes the development design of wideband antenna components to fulfill future needs, and the proposal of a new radio telescope with an effective collecting area of one square kilometre, the so-called '1 kT array'. CSIRO is involved in both aspects, with the development of new ultra wideband dielectric-lined horns, and the investigation of potential antenna designs for the 1 kT.

Attendance: 24

(2) 'Investigation of Wire and Patch Switched Parasitic Antenna Arrays',

S.L. Preston - 17 November

Stephanie Preston of the School of Micro-electronic Engineering, Griffith University, Brisbane, described her recent work on switched parasitic antenna arrays. These arrays provide an electronically-steerable beam and do not require phase shifters. The design of arrays of wires or patches was outlined, and included a discussion of fast methods for predicting element mutual coupling. Fast approximate methods are used to optimize the design and more accurate but slower methods are used to complete the design. The arrays have been optimized using a genetic algorithm which has resulted in physically-smaller arrays than those obtained by conventional design methods. Potential applications for switched parasitic antenna arrays include mobile communications base stations and low-earth orbit satellite tracking.

Attendance: 11

❖ **Ottawa:** Hugh Reekie, Chair; Yezdi Tamboli, Vice-Chair

(1) The most significant "event" was actually three events - a 7-hour video training program sponsored mostly by IEEE Ottawa Section, and co-sponsored by Ottawa Chapter MTT/AP. As one of my "many hats" in the IEEE Ottawa section, I agreed to be the "video co-ordinator" in late 1997. Some good, (but expensive) videos are at last coming out of Piscataway. The course was "RF Devices for mobile telephones" - as originally presented by IEEE E-D prior to their ED meeting in Washington in Dec 1997. We had 45 local engineers attend the course who paid fees from \$15 Cdn to \$90 Cdn, depending on circumstances. (2) Clint MacNeil (NAV CANADA), "Overview of the GPS Wide Area Augmentation System for Air Navigation System-a video." Date: 2/24/98; Attendance: 20. (3) Prof Wolfgang Menzel (University of Ulm, Germany), "Passive and active multilayer microwave components." Date: 3/26/98; Attendance: 20. (4) Prof Wolfgang Menzel (University of Ulm, Germany), "Planar and Quasi-planar An-

tennas." Date: 3/26/98; Attendance: 32. (5) Prof Wolfgang Menzel (University of Ulm, Germany), "Millimeter Wave Packaging and Interconnect." Date: 3/26/98; Attendance: 6.

Comment from the Chair: The IEEE Ottawa section is well placed (in this hi-tech community) to offer very specialist, timely, courses to engineers. The worst part of the whole course was finding out information from IEEE Piscataway. Their publications web page was terrible; it's got a bit better; but pertinent planning details of the course (e.g. video sector run times) were NOT available until the material arrived. This frustration continues with my Spring 1999 video program.

❖ **Poland:** Edward Sedek, Chair; Michal Mrozowski, Vice-Chair

I. Annual meeting and administrative meetings

The annual meeting was held in May 21, 1998 during the MIKON 98 Conference.

The Chapter activities during last two years were reported by the Chairman.

At the meeting the result of the election were announced. Plans for a next two years were discussed.

The meetings of the Administrative Committee were held in January, February, May and November.

II. Technical Meetings in 1998

(1) M.Sc. Pawe Kutysz (Technical University of Gdansk), "Classical spectral domain analysis of planar transmission lines." Date: 3/20/98; Attendance: 9. (2) M.Sc. Krzysztof Dorko (Technical University of Gdansk), "Properties of chiral and pseudochiral media." Date: 3/26/98; Attendance: 12. (3) M.Sc. Piotr Kozakowski (Technical University of Gdansk), "Fast techniques for the time domain analysis of high Q circuits." Date: 4/3/98; Attendance: 11. (4) Prof. Maria A. Stuch'y (University of Victoria, Canada), "Human body-antenna interaction in wireless communications." Date: 5/18/98. (5) Dr. Frank Henze (Huber+Suhner MRS GmbH, Bad Salzdetfurth, Germany) "Evolution of mobile communication systems." Date: 9/30/98. (6) Bernard Geller (Sarnoff Corp., USA) "Low temperature co-fired ceramics (LTCC) for

wireless applications." Date: 10/5/98; Attendance: 12.

III. International Conference on Microwaves and Radar MIKON 98

The conference was held in Krakow, Poland on May 20-22, 1998. The total number of participants was 268. Among them 78 persons were from abroad and 190 from Poland.

The conference was organized by Telecommunications Research Institute and Military University of Technology. It was supported by Polish Academy of Science, State Committee for Scientific research, IEEE AES & MTT Societies and AP/AES/MT and ED Chapters.

The members of our Chapter were very active in organization of the conference in particular: Prof. Józef Modelski (Past Chapter Chair) was the Technical Programme Committee Chairman, Prof. Edward Sêdek (current Chapter Chair) was the Chairman of Organizing Committee, Prof. Lesław Paradowski (Vice Chapter Chair - AES) was the Technical Programme Committee Vice Chairman and Prof. Tadeusz Wiêckowski (former Vice Chapter Chair - AP) was the organizer of the Workshop on personal communications. Our AES/AP/MTT Joint Chapter has supported 12 young scientists (10 due to EASS support and additionally

2 winners of the competition for the best Master Thesis on antennas, microwaves and radar technology).

IV. Support for young scientists attending MIKON 98 conference

Our Chapter has received a one time grant of \$1,500 from AESS for support of attendance by young engineers/scientists at the 1998 MIKON Conference. We would like to thank for this generous support which helped not only the young scientists but also had a part in the success of the conference. The conference organizers have agreed to decrease the fee for three of our young scientists from 190\$ (regular for IEEE members) to 140\$. The student fee was set on a low level of 70\$.

At last 10 young scientists accepted our proposal and attended the MIKON 98 Conference what resulted in higher amount of the average support than initially offered.

The list of supported young scientists attending the conference is given below:

V. Competition for the best M.Sc. thesis in the area of microwaves, antennas and radar technology.

The third edition of the competition was organized by the following competition committee:

Prof. J. Dobrowolski - Chairman

Prof. Z. Czyż

Prof. J. Mazur

Prof. L. Paradowski

Dr. Adam Abramowicz - secretary,

The third edition of the competition has been announced by the Chapter for students from Polish Universities who graduated in the period March 1996 - February 1998 in the field of microwaves, antennas and radar technology. The two prizes have been founded by the Chapter. The prizes included financial support in attending the conference MIKON 98 and additionally 200 z³ in cash.

The results of the competition are as follows:

two equal second prizes:

- M.Sc. Wojciech Komorniczak for a thesis entitled "Evaluation of the possible application of artificial intelligence methods in controlling radars" (in Polish), supervised by Col. Dr. Jerzy Pietrasinski, Military University of Technology; Department of Electronics;
- M.Sc. Piotr Kozakowski for a thesis entitled "Synthesis of nonuniformly spaced arrays using genetic algorithm" (in Polish), supervised by Prof. Michał Mrozowski and Dr. Włodzimierz

NAME	COUNTRY	ORGANIZATION	AGE		
1. Sergey Loyka	Belarus	Belorussian State University, Minsk	28	PhD, IEEE	190\$
2. Vladimir Trigubovich	Belarus	Belorussian State University, Minsk	25	PhD student	70\$
3. Tomasz Kuczerski	Poland	Military University of Technology, Warsaw	34	MSc	130\$
4. Artem Boriskin	Ukraine	Kharkov State University, Kharkov	21	student	150\$
5. Taras Holotyak	Ukraine	State University "Lvivska Politehnika", Lviv	24	PhD student	150\$
6. Alexander Yushchenko	Ukraine	Institute of Radiophysics and Electronics, National Academy of Sciences, Kharkov	34	PhD	220\$
7. Sviatoslav Voloshynovskiy	Ukraine	State University "Lvivska Politehnika", Lviv	26	PhD student	150\$
8. Goran Donic	Yugoslavia	Research and Development Institute Ei "IRIN", Niš	34	PhD	140\$
9. Natasa Trivunac-Vukovic	Yugoslavia	University of Niš, Faculty of Electronic Engineering, Niš	29	IEEE, PhD student	150\$
10. Sladjana Ivkovic	Yugoslavia	University of Niš, Faculty of Electronic Engineering, Niš	32	IEEE, PhD student	150\$

Zieniutycz, Technical University of Gdańsk; Department of Electronics Telecommunication and Computer Science

VI. Special prize for the best young scientist presentation at the conference MIKON 98

Our chapter has founded the special prize for the best young scientist presentation given at the conference MIKON 98. The Chapter Administrative Committee awarded the prize to Artem Boriskin (Kharkov State University, Ukraine) for the presentation of the paper „Complex source point beam scattering and absorption by a lossy circular dielectric cylinder” authored by A. Boriskin, S. Boriskina, A. Nosich. The prize is equivalent to the conference MIKON 2000 fee.

❖ **Santa Clara Valley:** Edmar Camargo, Chair; Steve Kenney, Vice-Chair

(1) Steven Goldberg (P-Com), “LMDS-What Will it Take to Make it a Household Word?” Date: 9/10/98; Attendance: 79. (2) Reza Ahy (BNA Systems), “Broadband Wireless Communications: Possibilities and Field of Dreams.” Date: 10/8/98; Attendance: 60. (3) Hans Rohdin (HP Labs), “A 0.1 AlInAs/GaInAs/GaAs Metamorphic HEMT MMIC Technology.” Date: 11/12/98; Attendance: 43. (4) Michael Fourcroy (Loral), “Evolution of the Communication Satellite Industry.” Date: 12/13/98; Attendance: 33.

❖ **Santa Fernando Valley:** James C. Weiler, Chair; H. Clark Bell, Vice-Chair

(1) Byron Edde (Quin Tech Corp.), “DSP Behind The Front Panel.” Date: 1/15/98. (2) Professor Dr. Wolfgang Menzel, (University of Ulm, Germany), “Millimeter-wave Packaging and Interconnect.” Date: 3/17/98. (3) Paul Draxler (Qualcomm Inc), “RF Circuit and System CAE Tools.” Date: 3/19/98. (4) Dr. Kikuo Wakino (Murata Manufacturing Company Ltd), “Miniaturization of Microwave Components for Mobile Communications Systems using High Dielectric Constant, Low Loss, Temperature Stable Ceramic.” Date: 5/7/98. (5) Dr. Christen Rauscher (Naval Research Laboratory), “Microwave Active Filters and Multiplexers: New Solutions

to Long-Standing Problems.” Date: 5/12/98. (6) Dr. Ken Weller (Rockwell

Semiconductor Systems), “GaAs HBT MMICs For Power Amplification In Wireless Systems.” Date: 5/21/98. (7) Dr. Bruce Kendall (3Com Corp), “Stupid Microwave Oven Tricks.” Date: 9/17/98. (8) Dr. Joel Dunsmore (Hewlett-Packard), “Band Pass Filter Tuning in the Time Domain.” Date: 11/12/98. (9) Dave Lux (NASA Program Manager for SR-71), “Research & Development of the National Space Launch Industry and its Commercialization, plus Details on the Linear Aerospike SR-71 Experiment (LASRE).” Date: 12/8/98.

The average attendance for all SFV Chapter meetings was 40.

❖ **South Africa:** David B. Davidson, Chair; John Cloete, Vice-Chair

(1) AJ Booysen (Grinaker), “Aperture theory and the equivalence theorem”, Date: 6/19/98; Attendance: 15.

(2) W Wiesbeck (Karlsruhe Univ.), “Aperture coupled, dual linear microstrip elements and arrays”. Date: 8/31/98, Attendance: 120. (3) Combined AP/MTT/EMC/REMSSENS/COMSIG’98 symposia, published as COMSIG 98, IEEE cat 98EX214. Approx 30 AP/MTT-theme papers. Date: September 7-8, 1998, Attendance: 120.

❖ **East Ukraine:** Prof. E.I. Veliev, Chair; N. A. Khizhnyak, Vice-Chair; A. I. Nosich, Secretary

I. Technical Meetings

(1) Workshop on Vacuum Electron Devices, 6 invited talks, 4 posters, 41 participants. Date: 11/12/97, Kharkov. (2) A.G. Nerukh (Kharkov Techn. Univ. of Radio Electronics), “Transformation of Electromagnetic Signals in Transient Media.” Date: 11/20/97; Attendance: 24. (3) Dr. I.Y. Vorgul (Kharkov State University), “Direct and Inverse Problems for the Media with Continuous Time Variation of Conductivity.” Date: 12/27/97; Attendance: 12. (4) Dr. Y.A. Yatsenko (Kharkov State University), “Radiation of wire antenna systems in anisotropic medium.” Date: 1/30/98; Attendance: 21. (5) Int. Conf. On Mathematical Methods in EM Theory (MMET’98). Date: June 2-5, 1998, Kharkov. Attendance: 250 + participants. (6) Int. Symp. Physics & Engineering of Millimeter & Sub-MM Waves (MSMW-98): 247 papers from 14 countries,

including 19 invited. Date: September 15-17, 1998, Kharkov. Attendance: 160 + participants. (7) Dr. B.I. Goleta (Nat. Center-Kharkov Inst. Of Physics & Technology), “Ozonators and Ozon Technologies.” Date: 10/12/98; Attendance: 23. (8) Dr. N. Ryazantseva (Inst. Radio Astronomy Nat. Ac. Sciences, Kharkov), “EM Wave Scattering by 2-periodic Magneto-Dielectric Structures.” Date: 10/31/98; Attendance: 22.

II. International Publication Encouragement Award of the East Ukraine Chapter

Given for a paper published in a refereed international journal, by any Ukrainian author, in the technical field of the Chapter. It consists of a certificate and a bottle of fine Crimean champagne, with the first awards being granted in January 1998 for 25 papers in IEEE Trans. AP, MTT, EMC, Radio Science, MOTL, JEW, IEE Proc. Antennas & Microwaves, etc. Of the 25 awards for 1997, 19 went to Kharkov authors.

III. Awards

The Chapter was recognized as the best chapter of the IEEE AES Society in 1997.

❖ **West Ukraine:** Nikolai N. Voitovich, Chair; Evgen M. Yashchyshyn, Vice-Chair, Mykhailo I. Andriychuk Secretary/Treasurer

I. Technical Meetings

(1) Dr. V. Yashin (Institute of Radio Astronomy of NASU), “Electromagnetic wave scattering by one and double periodic magnetodielectric gratings.” Date: 1/12/98; Attendance: 10. (2) I. Yu. Isaev (Physico-Mechanical Institute of NASU), “Modeling and Component Analysis of the Statistical Oscillations with Periodical Non-Stationarity.” Date: 1/12/98; Attendance: 15. (3) N. O. Popenko (Institute of Radiophysics and Electronics of NASU), “The scattering and absorbing the electromagnetic waves of millimeter range in resonant systems.” Date: 2/6/98; Attendance: 17. (4) Prof. Sergey Prosvirnin (Institute of Radio Astronomy of NASU), “Wave diffraction by chiral gratings.” Date: 4/24/98; Attendance: 17. (5) Dr. L. I. Zakalyk (State University “Lviv’ska Politekhnikha”), “Dependability Prognostication of the Contacts and Interconnections in the Integral Microschemes.” Date: 5/20/98; Attendance: 11. (6) Dr. R. O. Korzh

(State University "Lvivs'ka Politehnika"), "Thermodynamical Aspects of the Dependability Prognostication." Date: 9/17/98; Attendance: 10. (7) Dr. L. I. Zakalyk (State University "Lvivs'ka Politehnika"), "The Degradative Process Modeling in the Contacts and Interconnections." Date: 11/18/98; Attendance: 12. (8) Taras I. Vasylenko (Lviv State University), "The Numerical Methods for Investigation of the Non-linear and Parametric Systems." Date: 12/14/98; Attendance: 14.

II. Conferences/Workshops

(1) International Conference on Modern Problems of Telecommunications, Computer Science and Engineers Training. Date: February 23-28, 1998; Attendance: 234. (2) IIIth International Seminar/Workshop on Direct and Inverse Problems of

Electromagnetic and Acoustic Wave Theory (DIPED-98). Date: November 2-5, 1998; Attendance: 58.

❖ Washington DC/Northern Virginia:

Dr. Roger Kaul, Chair; John Margosian, Vice-Chair

(1) Erik Funk: Meeting to solicit next year's officers and to organize next year's lecture series. Date: 7/16/98; Attendance: 7. (2) Gabriel Rebeiz (Univ. of Michigan, Ann Arbor), "Micromachined (MEMS) Circuits for Microwave/MM Wave Applications." Date: 10/13/98; Attendance: 50. (3) Charles Goldsmith (Raytheon TI Systems), "Micromachining of RF Devices for Microwave Applications." Date: 11/10/98; Attendance: 57. (4) David H. Hinz (Raytheon E-Systems), "MEMS Tunable Bandpass Filters for Advanced

Digital Receivers." Date: 11/10/98; Attendance: 57. (5) Robert D. Streeter (Raytheon Systems Co.), "RF MEMS for Communication Applications." (6) Roger Kaul: Administrative Planning Meeting with Section Officers. Date: 11/16/98; Attendance: 6. Date: 11/10/98; Attendance: 57. (7) R. O. Gale and P. F. van Kessel (Texas Instruments, Inc.), "Principles and Applications of the Digital Micromirror Device." Date: 12/8/98; Attendance: 64. (8) Professor Clark T.-C. Nguyen (The University of Michigan, Ann Arbor), "Low-power Micro-mechanical Resonators for Miniaturized Communications." Date: 1/12/99; Attendance: 33. (9) Henry O. Marcy (Rockwell Science Center), "RF MEMS Activities at the Rockwell Science Center." Date: 2/9/99; Attendance: 38.

IEEE Teams Up With A University For A Pilot Program To Offer A Web-Delivered Course

PISCATAWAY, NJ, 28 January, 1999 – The IEEE has created an alliance with the Department of Electrical and Computer Engineering at the University of Illinois at Urbana-Champaign (UIUC), Urbana, IL, to offer a web-delivered course on antennas and propagation.

This four-week course, designed to serve as a refresher for practicing engineers, will be based entirely on the Internet. Classes run from 1 April, 1999 through 30 April. Registration ends 31 March, 1999. Course capacity is limited to 30 students.

The course will provide learners with an analytical and intuitive understanding of antenna physics, expose them to antenna computer-aided design software, and introduce them to a variety of antenna structures of practical interest. The course will also cover recent developments in the wireless and personal communication systems. Those intending to register are expected to have a basic knowledge of

electromagnetic wave theory outlining the general plane wave solution of Maxwell's equations, phenomena involving reflection and transmission of plane waves, transmission lines, and impedance matching techniques. Students who successfully complete the course will be awarded 3.6 IEEE Continuing Education Units (CEUs).

Eric Michielssen, Ph.D. will be instructing the course. Dr. Michielssen received his Ph.D. from the University of Illinois at Urbana-Champaign in 1992. He is an assistant professor in the UIUC Department of Electrical and Computer Engineering, associate director for the Center of Computational Electromagnetics, and a part-time faculty member in the Beckman Institute Photonic Systems Group. His professional interests are computational electromagnetics, photonic systems, high-speed digital circuits, fast algorithms, and stochastic optimization.

For more information about the course contents and requirements, and to register for the course, go to: <http://www.ieee.org/eab/distance/webcourse.html>.

The tuition for this pilot offering of the course is: Member price, \$350. List price: \$400. For more information about this educational opportunity contact Peter Wiesner, IEEE Educational Activities, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855-1331; Phone: 732.562.5500; Fax: 732.981.1686; E-mail: p.wiesner@ieee.org

The IEEE is the world's largest technical professional society, serving the interests of more than 330,000 members in the information and electrotechnology communities in approximately 150 countries. In keeping with its "Networking the World" slogan, the IEEE helps to foster technological innovation, enable members' careers, and promote worldwide professional community. 

Pioneer Honoree Article

Bob Eisenhart & Peter Khan

A Post in a Waveguide – Analysis and Application

Introduction

"Post in a waveguide" is an oversimplified but common description of an often used waveguide circuit, the subject of the paper "Theoretical and Experimental Analysis of a Waveguide Mounting Structure," written in 1971 by R. L. Eisenhart and P. J. Khan [1]. This paper became the basis for the 1999 Microwave Pioneer Award.

I believe that this is the single most important paper that has been published in the MTT Transactions on microwave waveguides. The paper made it possible to predict the embedding impedances of diode mixers and oscillators in waveguides over a wide range of frequencies, including harmonics. Previously, adjustments were done empirically, and they were quite difficult because of the complicated behavior of the impedances at different harmonics. In addition, the work gave a clear physical picture of what determined the impedance. The propagating modes contribute to the real part, the cut-off modes to the reactive part, and the shape and structure of the post gave the coupling coefficients to the modes. Finally, the measurements that accompanied the theory were so beautifully done that even though the behavior of the impedances was surprising, there was simply no doubt that Eisenhart and Khan had solved the problem completely.

– Professor David Rutledge,
California Institute of Technology

What constitutes a pioneering effort? By definition, it is a contribution to the profession published over 20 years ago and has had a major impact in the field. The following is the story about Eisenhart's and Khan's paper, where it started, what it contributed, and the impact it has had in the last 28 years.

Problem Description

In the theoretical analysis of oscillators, parametric amplifiers and frequency

converters, i.e. active circuits, general impedance functions $Z(f)$ are assumed to be known and are utilized accordingly as parameters when determining such quantities as power, frequency, gain, bandwidth, stability and noise figure. In a practical sense, this impedance for a microwave circuit as shown in Figure 1 was not available for design purposes. Determination of the impedance seen by the device becomes very difficult due to the complex nature of the configuration. In fact, the accepted view was that the post in a waveguide structure was electro-magnetically too complex to permit accurate modeling, and measurement techniques too primitive to permit reliable verification. Design of real sub-systems was done on a experience-experimental-trial and error basis. The question then was asked, why use such a complex structure? The answer came from experimental work that showed this circuit worked well for many applications because there is strong coupling between the "post" current and propagated energy within the waveguide.

Therefore, the objective was to characterize the impedance of the microwave mount (shown in Figure 1) commonly used for connecting small microwave devices in shunt across a waveguide. The term "impedance characterization" implies complete knowledge of the driving point and transfer impedances associated with and between each and every entry or terminal port of the mount. Once such a circuit is established, standard circuit analysis techniques can be applied to design the mount.

Analytical Development

Getsinger, in 1966 and 1967, suggested a relatively simple equivalent circuit for the waveguide mount [2], [3]. A more complete description was discussed by

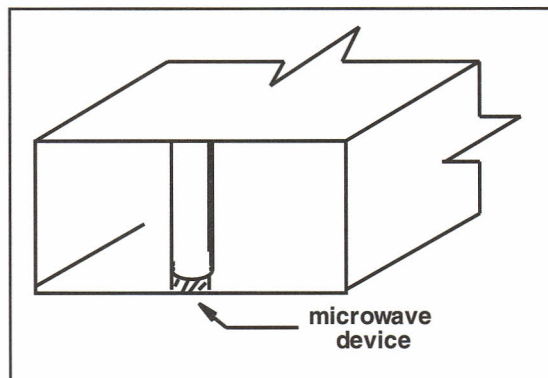


Figure 1. Typical mount configuration with the device mounted at the bottom of the waveguide.

Yamashita and Baird [4] who used the variational approach to solve for the impedance by considering the post as a radiating antenna element. They developed an equivalent circuit that helped them analyze the operation of a tunnel diode oscillator.

Yamashita and Baird provided the starting point for the subject analysis, which was then extended, based upon the induced e.m.f. method of Carter [5]. A five step procedure was set up [1] to analyze "the post in a waveguide" circuit: 1. Determine the dyadic Green's function for the waveguide. 2. Express the post current in a general set of orthogonal functions. 3. Determine an expression for the electric field anywhere within the waveguide. 4. Develop an expression for the electric field at the gap using the Lorentz reciprocity theorem. 5. Put the related expansion terms in the form of power equations and interpret as equivalent circuit elements. A simplifying approximation was to use a strip or flat post to represent a circular post [4] with the flat post width equal to 1.8 circular post diameter. The key deviation from [4] was the use of a general Fourier series in step 2, eliminating the assumption about the post current function. It was thought (correctly) that the impedance should be determined only by the configuration and

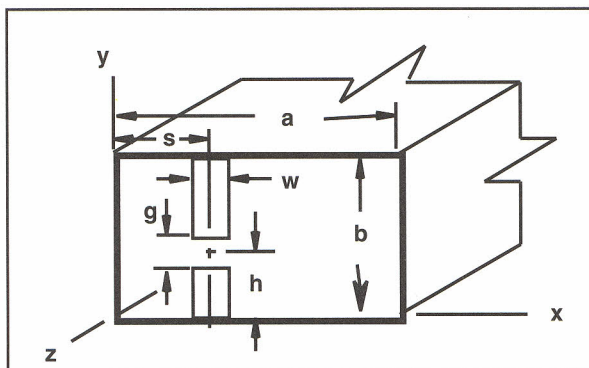


Figure 2 Description of mount parameters.

not dependent on the actual current. After much mathematical manipulation it became possible to show that the current function canceled out and only the dimensions of the structure were independent parameters. That was the first big breakthrough.

Although complex mathematics were used to develop the circuit element values, understanding of those mathematics is not necessary to appreciate and make use of the symmetries and simplicity of the resulting equivalent circuit configuration. Previous modeling attempts were incomplete or incorrect and never accurately predicted the desired impedance. The range of mount parameters and/or frequency were restricted. Usually the post was located in the center of the waveguide, and the device positioned at the bottom of the guide, as in Figure 1. In addition, the waveguide height was often reduced for matching purposes, and the frequency range restricted to that of the dominant mode. All of these restrictions were removed in the present analysis. The re-

maining restrictions relate to the size and shape of the post and gap, and do not significantly limit the applicability of the analysis since conventional diode dimensions fall easily within acceptable ranges.

All of the mount configuration parameters, shown in Figure 2, are variables and the significance of each parameter is determined in the resulting characterization. All evanescent and propagating modes are included in the analysis. This provides considerable

generality in the design of circuits. The modeling was sufficiently precise to be useful at frequencies well above the fundamental-mode band, describing harmonic circuit loading as well.

In addition to Yamashita and Baird, other "shoulders" that deserve mentioning include:

- a) W. J. Getsinger - Approach to equivalent circuits.
- b) Prof. C. T. Tai - Guru of Green's Functions and Doctoral Committee member.
- c) Prof. R. E. Collin - Lorentz Reciprocity Theorem in *Field Theory of Guided Waves* [6].
- d) Fourier - Thanks for the Series representation
- e) P. S. Carter - Thanks for the induced e.m.f. method

A technical report [7] documenting the work for the research sponsor is a more

complete development than what is in the Transactions article [1].

Equivalent Circuit Representation

The equivalent circuit takes into account the effect of a doubly infinite number of waveguide modes, all connected together. Two issues are: 1) what are the broadband characteristics of the waveguide modes, and 2) how do they couple together. Figure 3 answers the first issue; it shows the form of the TE and TM mode impedances over the full frequency range from zero to infinity. As shown, modes with like indices sum to an unusual characteristic, designated as Z_{cmn} . This is capacitive at low frequencies, goes through a zero becoming inductive up to a pole at cutoff. It then becomes resistive representing a propagating mode carrying energy away. Each m, n pair creates one set over frequency, referred to as a mode pair.

The second issue is addressed in Figure 4 which shows how the modes are coupled together. This coupling is really simpler than it looks because the transformers are just scaling elements. They set the coupling coefficients between the modes and the rest of the circuit. The "Gap" terminals, that is the input to the circuit that a diode sees is at the upper left. The Z_G shown is the impedance that terminates the gap if one looks in from one of the waveguide ports, effectively reversing the input and load.

There are two separate coupling mechanisms for the transformers, each made up by two factors. The first factor in each case is the positional factor. Figure 5 shows

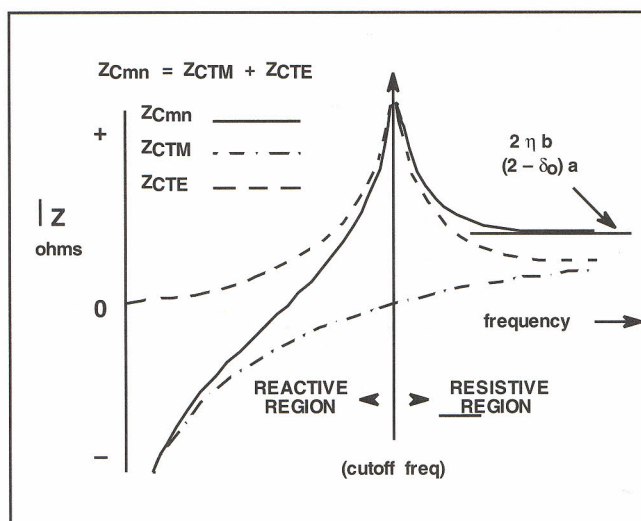


Figure 3. Mode Pair Impedance Plot

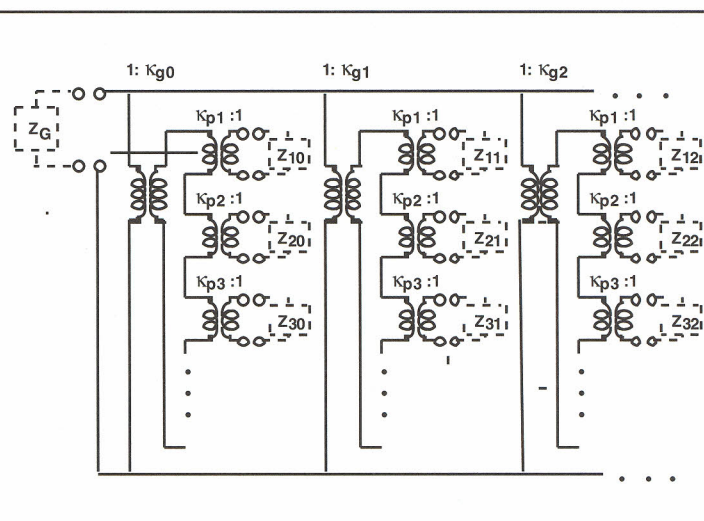


Figure 4. Equivalent Circuit of the Post Mount

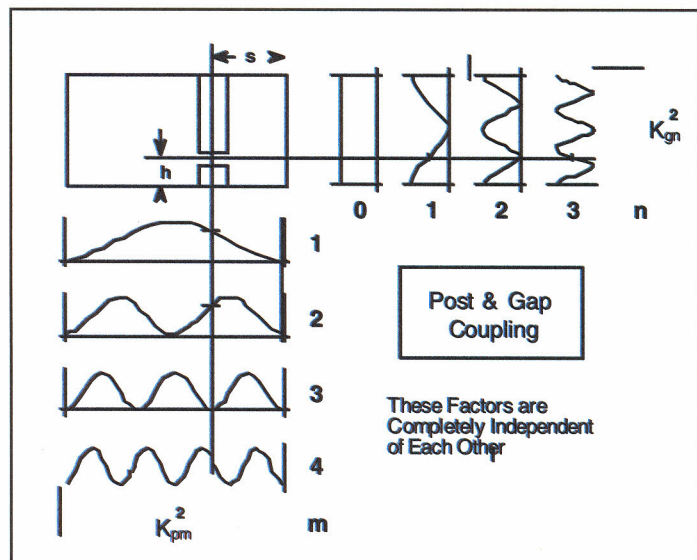


Figure 5. Graphical description of how the mode coupling is determined.

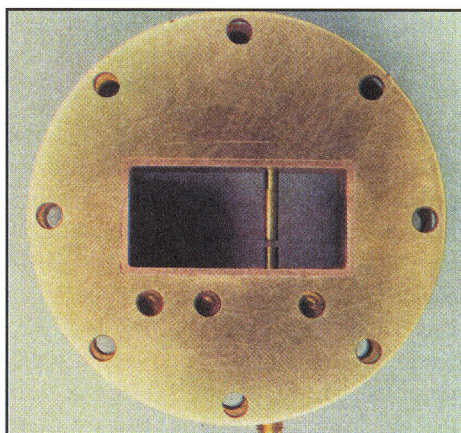


Figure 6 C-band test fixture

conceptually how the positional factors are determined for an arbitrarily placed gap and flat post in the waveguide cross-section. Note for example the "n" index on the upper right. The four values for n are the labels for four mode field variations for the respective modes. The horizontal line through the middle of the gap (at height = h) marks a value between 0 and 1 for each of the four modes, defining the "n" positional factor. This factor is simply a function of where the gap is in the post and is called the "Gap coupling factor".

A corresponding "Post coupling factor" is related to the position of the flat post with respect to the waveguide side-walls. Again note the various coupling values indicated with the vertical line for the different "m" mode indices. This process holds for the infinite number of modes for both m and n.

The second factor in both coupling relationships is a convergence factor that simply de-

termines how many modes should be included for both m and n indices. These factors are related to the gap size (gap coupling) and post width (post coupling). (Note: modes for m = 0 do not exist)

The equivalent circuit of Figure 4 simply provides a means of defining the coupling between the impedance present in the gap and the mode impedances present in the waveguide arms. It is a linear, passive, reciprocal, doubly infinite network whose elements are a function only of the mount parameters shown in Figure 2. A summary of the mount parameter primary effects shows that:

a = Waveguide width – sets dominant mode frequency range
b = Waveguide height – multiple effects on mode characteristics
h = Gap position – gap coupling coefficients
s = Post position – post coupling coefficients
g = Gap size – sets "n" index convergence
w = Flat post width – sets "m" index convergence.

Experimental Development

Experimental analysis was carried out to guide and verify the theoretical work. Measurement of this terminal impedance was not considered possible because of the inaccessibility of the terminals. This fact probably accounted for the lack of published material dealing with the problem. However, with the advent of subminiature coaxial cable and connectors, it was possible to isolate the terminals electrically without affecting the surrounding field conditions by running the measurement circuit cable inside a circular post. A versatile mount fixture, shown in Figure 6, was designed

incorporating this concept to allow impedance measurements for different gap position "h" and post position "s", shown in Figure 7. This simple approach of the cable in the post was a second big breakthrough. If the experimental effort had not produced such reliable and self-consistent results, the necessary insight to develop the theory would never have been obtained

More specifically, the data indicated that the doubly infinite waveguide modes should be combined as a sum of an inverted sum, rather than as a double sum. This was a significant deviation from prevailing approaches [4].

This C-band test fixture (fundamental mode @ 4-6 GHz.) was built and used for characterization up to 22 GHz. where many higher order modes are propagating. A small, 0.065 inch diameter coaxial cable was put inside the post to measure the mount as a terminating load. Measurements are shown for a range of mount parameter values. Figure 8(a) shows the impedance for the most typical mounting configuration, where the post is centered and the gap is at the bottom. Figure 8(b) shows the result of moving the gap halfway up the post. Since the post is centered, only coupling to the m odd modes exist. One of these, the TE₃₀, has a pole at 9.45 GHz, that causes the resistive part to have a zero at that frequency by decoupling energy to the TE₁₀ propagating mode. Additional test configurations are included in [1].

The two graphs of Figure 8 show a high degree of correlation between the theoretical

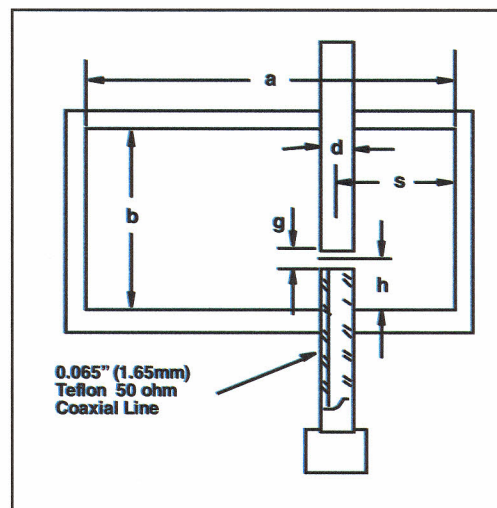


Figure 7. Versatile measurement mount

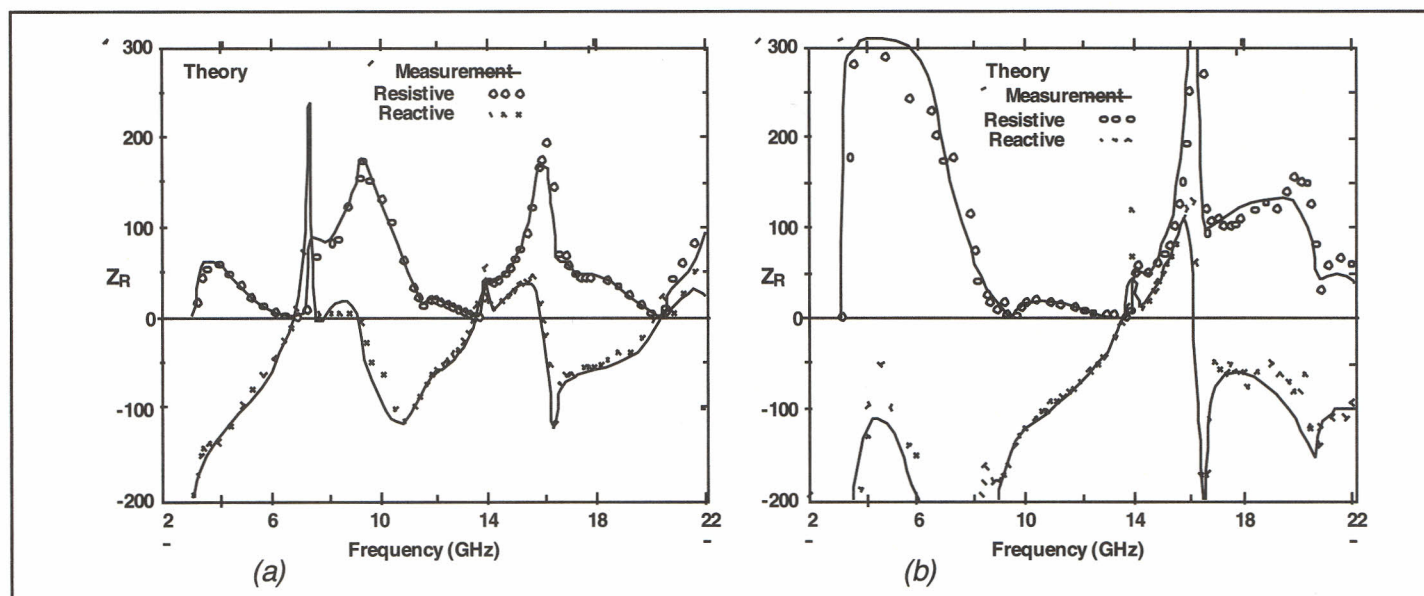


Figure 8. Theoretical and experimental impedance comparison for different configurations of the mount. (a) $s' = 0.5$, $h' = 0.035$, and (b) $s' = 0.5$, $h' = 0.5$

results and the measured data. Based on all of the data taken, it was reasonable to conclude that the theory presented was valid and that the measurement technique developed was highly successful. Since the measurement technique had proven itself, it could be used in applications where the configuration could not be handled theoretically, thus providing a unique capability.

The experimental part provided an instrumentation technique to measure Z_R inside the waveguide, providing confirmation of the equivalent circuit (analysis). This technique has also been independently applied to a variety of structures where an internal terminal impedance characterization is desired.

Post as an Obstacle

The terminals of Figure 4 associated with the propagating modes can be considered as input ports for each respective mode,

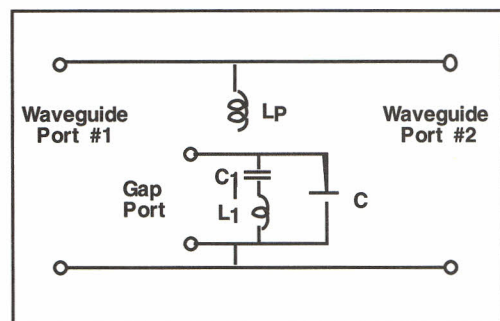


Figure 9. Post circuit for incident TE10

thus allowing description of the mount as a load to an incident waveguide mode. The case of the incident fundamental TE10 mode deserved special attention. Figure 4 can be "turned inside-out" to result in Figure 9, which has the TE10 terminals as the two waveguide ports. For this restricted frequency band, all of the other modes can be consolidated into one of the four reactive elements shown.

LP is the sum of the rest of the $n = 0$ modes.

$C1$ = capacitance due to Tmm1 modes.

$L1$ = inductance due to Tem1 modes.

C = combined capacitance effect of all TE and TM modes for $n > 1$.

Some related measurements were made using standard techniques for the TE10 mode. An interesting case is that of the "tuned post" represented by the family of curves in Figure 10. The gap size is varied from zero to slightly larger than $1/4$ the guide height. The gap impedance Z_G is determined simply from the parallel-plate capacitance of the end of the circular post, which was centered to decouple the TE20 mode. This extended the dominant mode region to 7.46 GHz, the cutoff frequency for the TE11 and TM11 modes, thus permitting

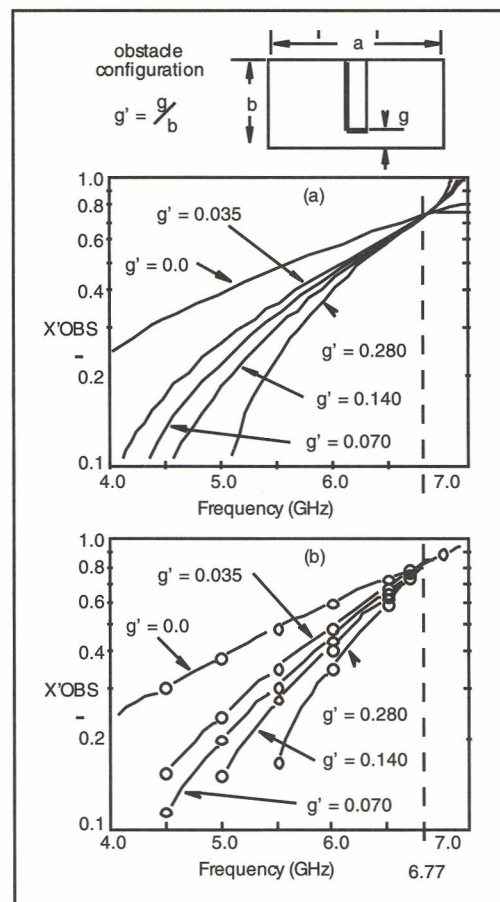


Figure 10. Obstacle reactance for gap size "g" variation with $s' = 0.50$, $w' = 0.115$. (a) Theory (b) Experiment

observation of the characteristic at 6.77 GHz where the reactance is independent of the gap size. Actually, the reactance is

independent of any impedance Z_G which happens to be present at 6.77 GHz because the admittance function is infinite at this frequency due to the resonance of C_1 and L_1 shorting out the gap. This interesting feature would not be present if the gap were centered halfway up the post.

Electronically tunable elements can be designed using voltage-tunable devices mounted in this matter. By using reduced height waveguide, the resonant frequency would be pushed higher, eliminating the restriction on the tuning curves. An example of such an element is the common switching element employing a PIN diode as a variable Z_G .

The second example shown here has the gap shorted (post from bottom to top) thereby leaving only the post inductance. (other examples are shown in [1]) Figure 11 compares measurements for a circular post and flat post with the theory for the flat post for three different positions across the waveguide. This confirms that the approximation is justified for a flat post with a larger dimension representing a circular post.

Gunn Oscillator Behavior

During the circuit development several papers appeared that described unusual and unexplained tuning behavior of a Gunn diode in a waveguide mount with a sliding short. In some cases the oscillation frequency was relatively insensitive to the tuning plunger position. In others, abrupt

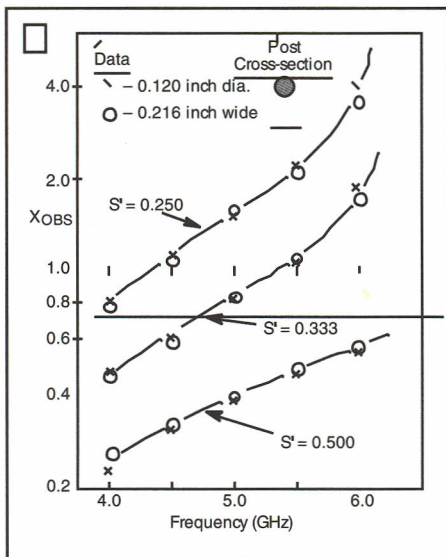


Figure 11. Post cross-section comparison

changes in frequency and power output observed. These observations represented a ready-made opportunity to test the new equivalent circuit. The circuit model was extended to include the packaged diode and a tuning waveguide short circuit [8], as shown in Figure 12.

Figure 13 shows some frequency and power behavior predicted by the mount circuit, that closely resembles the published experimental results. Each curve in Figure 13(a) is directly related to a frequency versus L tuning curve of the form in Figure 14. Consider tuning the mount by increasing L , starting with $L \sim 0$. At some point the device starts to oscillate, with resulting output power. If the conductance associated with the tuning curve becomes greater than $|G_D|$, the oscillation at this frequency will cease. However, if another resonant condition exists, a new oscillation will be initiated at a reduced power level. This change-over will appear as a frequency and power jump and is indicated by the first discontinuity in Figure 13 at point 1. As long as the $\lambda_g/2$ curve remains above $|G_D|$, the tuning will follow the λ_g curve as shown up to point 2. There transfer takes place back to the $\lambda_g/2$ curve with the associated frequency and power jump. The next transition occurs at point 3, where it is observed that frequency jumps due to the curve transfer, but with a relatively constant power output due to continuity of G_L .

Figure 14 shows the frequency variations for the tuning discussed. A "frequency saturation" effect is also shown here whereby the tuning curves are limited at the high frequency side by the 19 GHz boundary, established by the series resonance of elements C_1 and L_1 in the circuit. This is the

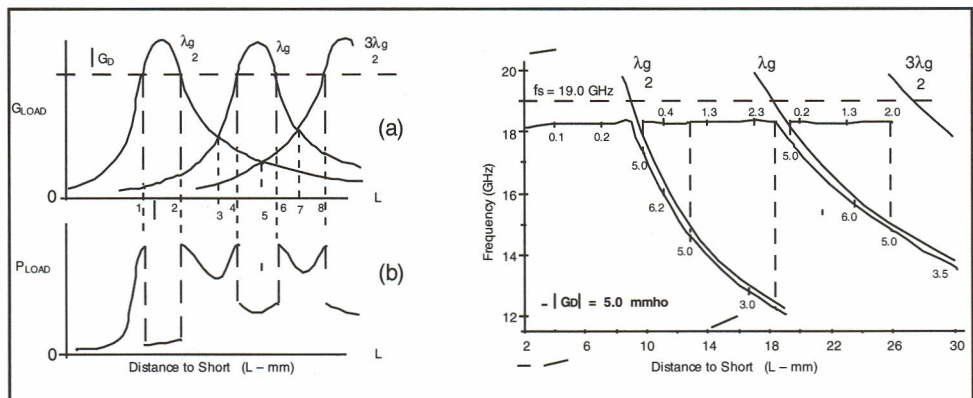


Figure 13. Typical curves for a multiresonant waveguide mount.

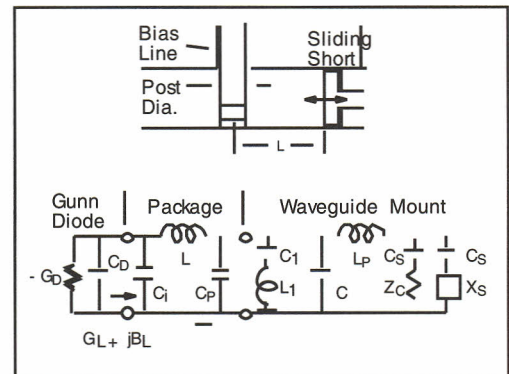


Figure 12. Ku-band diode mount circuit

same resonance noted in Figure 10 and can be similarly increased by simply decreasing the guide height. This figure also shows the conductance values along the curves. Note that the tuning point leaves the curve when the conductance exceeds the maximum value for $G_D = 5.0$ mmho, jumping to the next available tuning condition. It also jumps back to the initial curve when the conductance drops back down below 5.0 mmho.

By using the "post in a waveguide" circuit, it was possible to fully explain the frequency tuning, jumping, and saturation along with output power variation and jumping that was being reported by others in the literature. This "tuning characteristics" paper was referenced 17 times through the mid-eighties and was a strong contributor in convincing people of the power and utility of an accurate circuit model.

Coax-Gap Equivalence

It had been suspected for many years that a gap at the end of a post would have similar input impedance characteristics as a small coaxial entry with the post as the

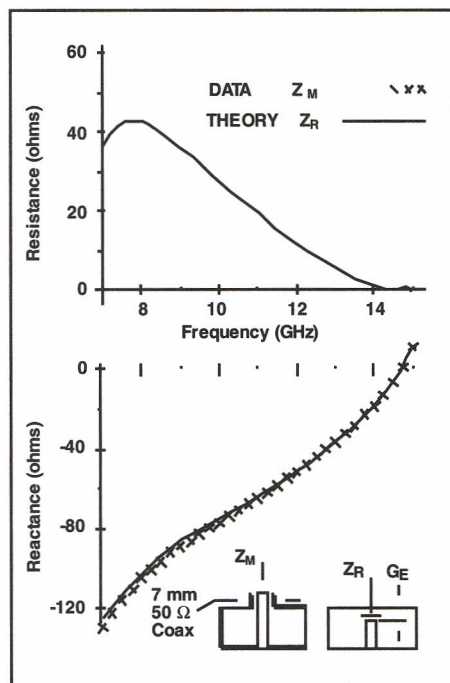


Figure 15. Impedance comparison for equivalent gap versus coax

center conductor [6],[9]. Measurements were made and compared with the theory to determine if there was some sort of equivalence [10]. Figure 15 shows a close correlation between the post gap [1] and a coaxial entry in the broadwall of a waveguide, measured in X-band waveguide.

It is concluded [10] based upon these measurements that the coax-waveguide junction can be represented by a post with a gap for nominal values of post and coax size. This then allows direct circuit design to be applied to configurations using the coax-waveguide junction.

Extension to Two Gaps

Another very useful configuration which is related to the "post in a waveguide" is one with two gaps in the post [11]. Figure 16 shows the versatility of this arrangement, and Figure 17 shows the equivalent circuit.

This circuit has all of the same modes as before but additional coupling mechanisms between the gaps and the modes now exist in addition to the second gap.

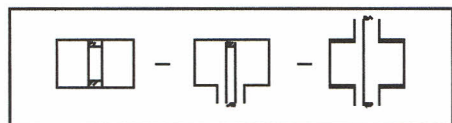


Figure 16. Equivalent waveguide configurations for which the 2-gap circuit can be applied

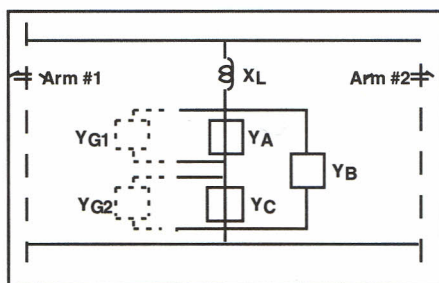


Figure 17. Simplified 2-gap circuit

The same freedom to place the post position and the two gaps along the post is inherent in the circuit elements, and there is no restriction on the loading of the coaxial lines or the waveguide arms. The gap and coax configuration could represent a parametric amplifier, or upconverter which has the appropriate filter in the coax line and a varactor in the gap. It could also be an IMPATT or Gunn oscillator with a sliding short in the waveguide, and using the coax to model the bias line with some loading as demonstrated by Kurokawa.

Figures 18 and 19 show a couple of additional comparisons of theory and experiment for variations of the 2-gap configuration. Figure 18 uses a standard packaged varactor in the gap with two different bias conditions to show the effect of changing the capacitance in the gap. Surprisingly, there is more shift in the resistance than in the reactance. Nominal values for the varactor and its package elements were used so some of the deviation from theory could be due to error in these values. Figure 19 addresses the double coax configuration with a varying load on the opposite coax port. One case has a 50 ohm termination and the others are two positions of a sliding short to simulate large changes in reactance.

The correlation is not perfect in these comparisons using coax but quite useable considering all of the approximations or "equivalencies" involved. Certainly the theory is accurate enough to do initial designs before fine tuning.

Contributions by Others

As the years have passed, application of these theoretical and measurement techniques have not diminished as use of waveguide circuits have shifted to higher frequencies. The rest of this article focuses on the works of others, who used the analy-

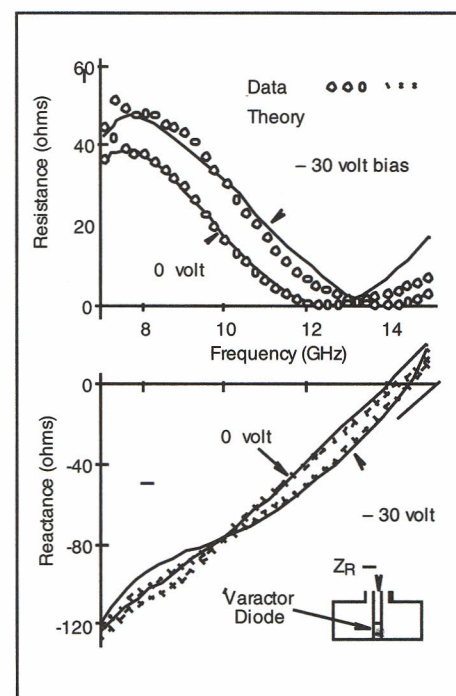


Figure 18. Theory and experimental comparison for varactor tuning

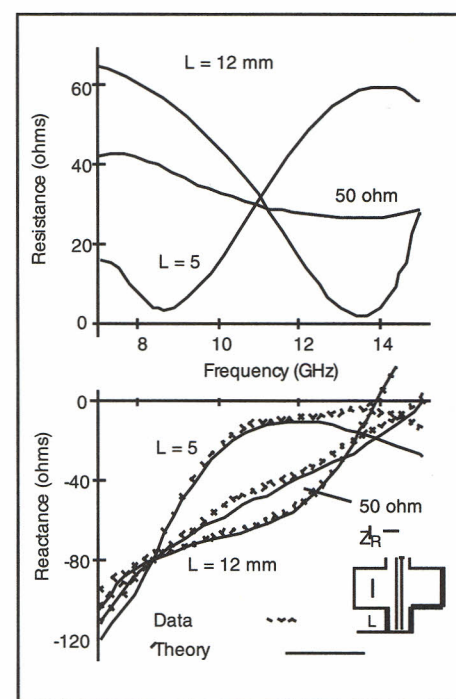


Figure 19. Theory and experimental comparison for a load and sliding short

sis/measurement technique to do something new or extended the analysis to a different application. Some of the more unique or interesting papers of more than 100 appearing since 1971, are briefly discussed, more or less in chronological order.

Jethwa and Gunshor used the equivalent circuit to explain tuning and mode jumping effects for a Gunn Diode Oscillator [12]. This parallels the results of [8].

Williamson published many papers for a variety of waveguide mounts but he takes into account the cylindrical nature of the post. The first of these [13] shows results only, comparing to measured data of [1]. Full analytical disclosure is made later in 1982 [14].

O. L. El-Sayed had the first paper to apply the analysis to two flat posts in the same waveguide cross-section [15].

Next is a discussion of five papers by A. R. Kerr, either as author or co-author demonstrating improvement in mixer performance. The first is a landmark paper in low-noise millimeter-wave receivers [16]. It is the first time cryogenically cooled Schottky mixers were used, and the noise temperature was about half that of the pre-

vious state-of-the-art. The use of [1] was to provide an understanding of the waveguide mount to the author so that the design would allow the diode to see an acceptable impedance over the whole waveguide band. Previously, attempts had been limited to cases in which the diode had a fairly simple embedding network. The second paper was selected for the 1978 Microwave Prize [17]. This was the first accurate analysis of a Schottky diode mixer, taking into account harmonic terminations up to 6fLO. This paper used the experimental technique on a 64 x scale model so that the embedding impedance for a greater than 6:1 frequency range could be characterized. Figure 20 shows how the cable replaced the Schottky diode to make these measurements. The third paper demonstrated for the first time the accuracy of Tucker's three frequency quantum mixer theory using an SIS mixer with a fairly large ωRC product [18]. This paper used the experimental technique on a 40 x scale model so that the embedding impedance could be accurately measured. The fourth paper also used the measurement technique [19], this time on a 100 x scale model over 6fLO. The fifth paper was the first 100 GHz mixer to come close to the fundamental quantum noise limit with $T_{\text{mixer}} < 5.6\text{K}$, non-classical conversion loss ($L = 0\text{ dB DSB}$), and negative IF output resistance (in a resistive mixer) [20]. In this paper, the form of the equivalent circuit is based upon [1], from which it was possible to identify the circuit reactances with energy storage in particular groups of evanescent waveguide modes. This choice of equivalent circuit results in elements that are not strongly frequency dependent, and allows a more intuitive understanding of the mount. Actual values were measured using a 40 x scale model.

Alexander and Khan applied the analysis to a coaxial cavity with a gap in the center conductor [21].

J. Joshi did a major extension of the analysis in 1977 with a pair of papers, characterizing the circuit to allow multiple semiconductor devices to be included, and subsequently a development which allowed multiple posts with different devices in the gaps [22]. The first of the pair provided a more general extension to multiple gaps, allowing them to be either in the

same post or separate posts. The second paper then discussed in detail the cases of two gaps. The two post configuration allows much more flexibility in circuit design and has been applied successfully to varactor controlled oscillator circuits. Such an application was not feasible with the two gaps in a single post because of the need for independent biasing of the varactor and source diodes. Application of this work led to a large program at Philips Broadband Networks supplying Varactor tuned Gunn oscillators for the Skyflash air-to-air missile over several years.

Eaton and Joshi followed with an excellent applications write-up for the two post configuration [23]. This discusses many options with the posts, gaps, and other parameters involved, leading to the successful design of commercial products.

Mizushima et al. applied the basic analysis to a ridged-waveguide configuration, resulting in wider bandwidth operation for the mount [24].

Here is another group of three papers with an interesting similar extension of the analysis. Rutledge and Schwarz demonstrated the flexibility of the analysis approach for active structures (detector and oscillator grids) [25] when it was determined that if free-space modes were substituted for the formulation, then the impedance for these structures could also be predicted with excellent agreement between theory and experiment. This was particularly interesting because there is no waveguide. Popovic et al. represents another extension, this time to a 2-dimensional grid loaded with transistors, placed inside a Fabry-Perot cavity, and demonstrating a quasi-optical approach for generation of microwave power [26]. The grid acts as an active surface with a reflection coefficient greater than unity, allowing oscillations to build up. Assuming an infinite array of devices and a plane wave excitation, an equivalent waveguide unit cell is defined for a parallel plate waveguide, having electric walls on the top and bottom and magnetic walls on the sides. An equivalent circuit can then be developed for this configuration, adapting for the modified waveguide. Popovic et al. then used a similar approach to the "Bar-Grid" paper, with a modified config-

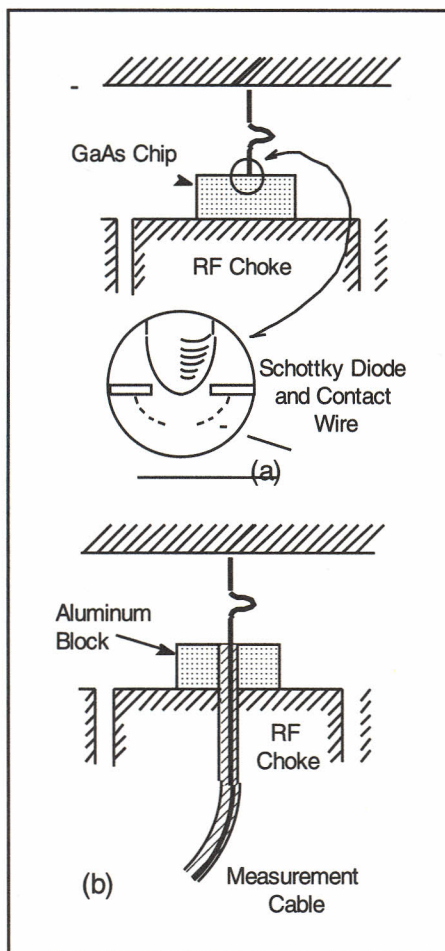


Fig. 20 Model for embedding impedance measurement. (a) Actual configuration (b) Scaled model with cable

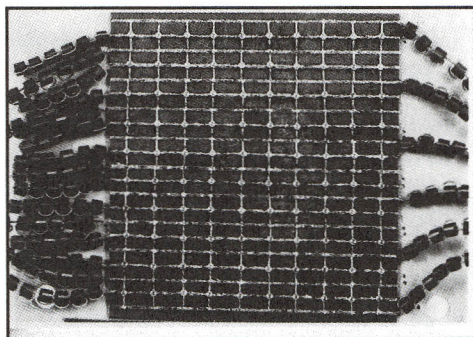


Figure 21. 100-MESFET array

uration, this time supporting 100-MESFETs on a substrate [27]. Figure 21 is a photo of the 100 element planar array. Biasing lines are connected to the sides of the array. Figure 22 is a closer view of the connections to the individual MESFETs and it shows the symmetry for defining the unit cell. All of the devices share the same biasing and tuning circuit, making the structure attractive for combining a very large number of devices. This paper was also awarded the Microwave Prize.

Hicks and Khan investigated the equivalence ratio between round and flat posts by taking into account the current variation across the post [28]. Curves are provided, showing the dependence on post diameter, post position and frequency.

Skrehot and Chang used the equivalent circuit for the two gap configuration in a novel way to characterize the material of the flat post [29]. The calculated resonant frequencies and normalized surface resistance agree well with the measurements over a frequency range of 8 to 18 GHz.

Bates and Ko used the measurement technique once again to confirm an analysis for a complicated circuit, this time having very irregular radial resonant elements [30].

Conclusions

This article has given an overview of the contribution of the paper upon which the 1999 Microwave Pioneer Award was based. The subject paper provided a theoretical solution of the general problem of the circuit impedance seen by a device mounted in shunt across a waveguide. The resulting equivalent circuit can be used to improve the design of waveguide oscillators, amplifiers, frequency multipliers and converters,

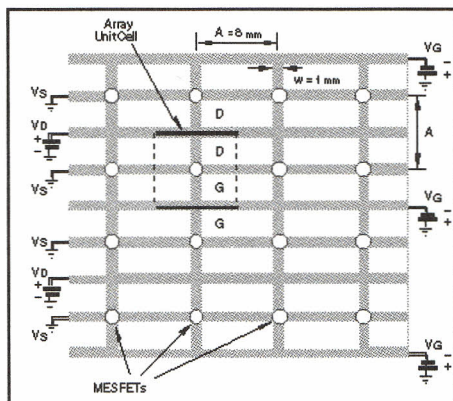


Figure 22. Biasing arrangement for the array Unit Cell

phase shifters, mixers, attenuators and various filter elements. A validating measurement technique was presented. A variety of applications of the analysis and measurements were discussed, including the related works of others.

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Robert (Bob) L. Eisenhart - Meeting the other side

Bob Eisenhart is a Texan by birth but never lived in Texas much. His dad was an Air Force pilot and the family was always on the move. Growing up on Air Force bases was a great opportunity to learn about all of the planes so naturally he wanted to be a pilot when he grew up. Poor eyesight put an end to that. Attending ten different schools for grades 1-12 wasn't much fun but the traveling was and having your senior year in Paris (France) American High School made up for a lot of it.

Boy Scouts occupied his spare time prior to high school, enjoying summer camps in Alabama, Virginia, Ohio and his favorite in the Black Hills of South Dakota. He was fortunate to attend the National Boy Scout Jamboree in 1953 in Irvine, California, traveling with his troop from Ohio and seeing sights all across the US.

Bob always enjoyed sports and is still active in many. High school teams included football, gymnastics and golf. In college (at RPI) he continued with football and golf and also got involved with the water sports of swimming and water polo. Graduate school at the University of Michigan was mostly studies, except for a little time in the woods hunting with bow and arrow. It was a chance to get away and clear the head, out in the Michigan

autumn countryside (with a side benefit of a freezer full of venison).

College graduation first led to an oil refinery in Texas with a \$500 per month salary. After Bob received his military orders (and a pay cut) he had a five year period with the Army Security Agency, including a tour of duty in Europe. This was during the hottest period of the "cold war," including the Cuban Crisis and the Berlin Wall. A memorable moment came when scanning with binoculars across the East-West border from a mountain-top position, and spotting an East German guard who was watching with his binoculars and waving back. Also, going to Berlin on the train through East Germany was always an adventure.

A marriage was the main personal event of that time, unfortunately lasting only 9 years. Finishing graduate school started a new life and career.

Working for Hughes in the 70s and 80s didn't leave much time for golf so he took up tennis, scuba diving, skiing and backpacking. These represented new excuses to enjoy the full "California lifestyle," have some fun and to see a lot of the state. Still there after 28 years, having finally found a place to call

home. A bonus came with the tennis, meeting Nancy at a tennis party, beginning a relationship that is now at 17 years of marriage. Along with Nancy came three step children, who eventually produced ten lovely grandchildren. Bob's own two boys by his first marriage, are unmarried, both into music. The oldest is a Music Director at a local high school (shades of Mr. Holland's Opus) and the younger is a performer.

To spice up his life during the working years, he moonlighted as a professional tennis umpire, working matches for all of the greats of the time. The excitement of being on the same court with these players from Billy Jean King to Michael Chang sparked the interest for 12 years, highlighted by a Davis Cup Match in 1979 and the US Open in 1989.

He now has a home-based consulting business, and is supposed to be slowing down a bit (having resumed his golfing and cutting back on the hiking and diving). As Chairman of the 1999 International Microwave Symposium in June, the slowing down will have to wait at least until July when he and Nancy will go to Alaska for two weeks, about the only state he has not yet been in. When they get back, the golf game will finally get the attention it deserves.

Peter J. Khan - Personal Details

Peter Khan was born in Mittagong, a small country town in Australia which is distinguished as the area where Australia's most famous cricketer, Don Bradman, grew up. As a result Peter developed a lifelong enthusiasm for cricket, which was lamentably unmatched by any distinction as a player.

Proceeding through school, Peter enriched his education and his purse by such diverse occupations as writing a sports page for a local weekly newspaper, working on a farm, and delivering ice to homes without refrigerators. Such pursuits provided strong motivation for seeking a college education.

Engineering studies at Sydney University were supplemented by experience in technical facilities all over Australia, together with a period spent enjoying the company of kangaroos and emus in the vast central Australian desert while he was stationed at the Woomera missile-testing range. Extra-curricular activities included coaching a women's cricket team and promoting a scholarship programme for aboriginal Australians.

Upon completion of his studies Peter took advantage of a Fulbright Post-doctoral Fellowship to continue his research at the

University of Michigan where he received a faculty appointment. Arriving in 1963, he was able to experience his first snow-storm, which was a prelude to a typical Michigan winter.

In 1967 he married Janet, an Australian who was completing her doctoral studies in counseling at Michigan. Both share a deep affection for the United States and its people, and their vacation travel to some 45 states in USA over the years gave them the opportunity to admire its beauty and diversity. Their membership in the Baha'i Faith brought them into close contact with Americans from a wide range of backgrounds.

After 12 years of Michigan winters, they decided to accept faculty positions in sub-tropical Queensland, Australia, and reluctantly left the stimulating intellectual environment of Ann Arbor. However this move gave them new opportunities to satisfy their curiosity about other parts of the world. Peter accepted an appointment to an honorary position as an advisor to National Baha'i Assemblies in the Australasian region, as a result of which they traveled extensively in the Pacific Islands during University vacations. From this came Peter's continuing interest in the

history and cultural anthropology of the peoples of the Pacific, and their interaction with the nations of the Pacific rim. It served also to invigorate his passion for stamp collecting.

In 1983 Peter and Janet decided to conclude their academic careers, and to proceed to live in Israel where they serve as religious volunteers at the Baha'i World Centre on Mount Carmel. In 1987 Peter was elected as a member of the Universal House of Justice, the nine person international governing body of the Baha'i Faith, which supervises and coordinates the work of its 182 National Assemblies throughout the World.

They continue to travel, as time and circumstances permit, to all continents. One of their most vivid memories is of a brief sojourn with Kalahari bushmen in Botswana, who solicitously advised them not to leave the small frail shelter in which they were spending the night because of the prospect of lions wandering through the encampment during the evening.

Peter and Janet have recently published a book on "Advancement of Women" and are preparing to visit Mongolia en route to Australia on vacation. 

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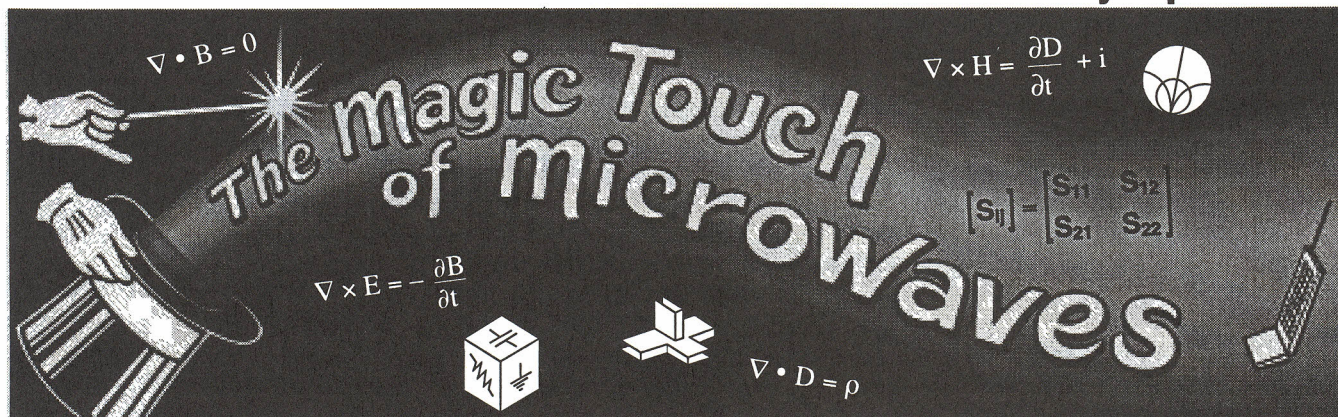
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The plenary session is an integral part of the IMS Technical Program and will include presentation of the 1999 IEEE Electromagnetics Award to Prof. Robert E. Collin and IEEE Fellows Awards to MTT-S recipients. Dr. John Forrest, Vice President of the Royal Academy of Engineering (UK), will present the keynote address, "Communications Networks for the New Millennium." Dr. Forrest's address will be the first of a series of theme presentations throughout the IMS technical program, in focused sessions, panel discussions and workshops, emphasizing the technical program theme: "Technologies for the New Millennium."

WORKSHOPS

The IMS workshops provide information on the latest technology being used and developed in the microwave industry. A total of 21 workshops will be held on Sunday and Friday of Microwave Week. These workshops are tutorial and interactive. All will provide you with critical knowledge needed to succeed as an RF/microwave professional.

RADIO FREQUENCY INTEGRATED CIRCUITS SYMPOSIUM (RFIC)

Since its new mission was defined in 1997, the RFIC has established itself as the leading symposium dedicated to highly integrated and system-on-a-chip (SOC) ICs and subsystems. Technical activities include a workshop on Sunday, technical sessions on Monday and Tuesday, and a panel session on Monday. The symposium kicks off with an invited session on Wireless Communication IC Trends. This year's symposium highlights the accomplishments and technology breakthroughs in low power transceivers, "digital" radios, analog and digital function integration, third-generation cellular phones, etc... The second day of the symposium includes a session held jointly with the IMS and highlights the advancement in microwave and millimeter-wave ICs for commercial and military applications.

The RFIC social program will include the traditional reception held on Sunday evening and the *Microwave Journal*/MTT-S Reception on Monday evening.

53RD ARFTG CONFERENCE

The 53rd Automatic RF Techniques Group (ARFTG) Conference will be held at the WestCoast Anaheim Hotel on Friday, June 18. The Conference theme is "Non-linear Characterization."

The explosion of wireless communication has created many new challenges in product design and test. Increasing consumer usage requires tighter and tighter performance specs in markets that are more and more cost sensitive. In particular, getting non-linear devices to operate at lower voltages efficiently and in linear modes is often a conflicting trade-off. To meet these challenges, new techniques in measurement and design are required.

The ARFTG Conference theme will aim at characterizing components, subsystems and systems that contain non-linear elements. This includes automated techniques in test and design, and integrating the test/design process. In addition, other papers concerning RF/microwave measurements are invited.

MICROWAVE APPLICATION & PRODUCT SEMINARS (μAPS)

μAPS is a vendor forum featuring product-oriented seminars presented by participating exhibitors. Located on the trade show floor adjacent to the exhibition booths, these seminars offer the latest technology for the wireless, SATCOM, military and medical markets. Six sessions will include discussions on measurement techniques and theory; modeling, CAD and packaging; components; devices and applications; and wireless communications and amplifiers.

SOCIAL EVENTS

Microwave Journal/MTT-S Reception: All Microwave Week attendees and exhibitors are invited to attend a reception hosted by *Microwave Journal* and MTT-S on Monday, June 14 from 6:00 to 8:00 PM in the Arena at the Anaheim Convention Center.

Industry-hosted Cocktail Reception: Symposium exhibitors will host a cocktail reception on Wednesday, June 16 from 6:00 to 7:30 PM at the Anaheim Marriott. Complimentary beverage tickets will be included in the registration packages.

IEEE MTT-S Awards Banquet: The annual Awards Banquet will be held on Wednesday, June 16 from 7:30 to 10:00 PM in the Ballroom at the Anaheim Marriott. This magical evening will begin with an elegant dinner, followed by the awards presentation and entertainment by none other than "Marilyn Monroe," "Frank Sinatra" and others!

GUEST PROGRAM

Hospitality Suite: Guests of attendees are invited to visit the Hospitality Suite in the Veranda Room of the Anaheim Marriott. It will be open Sunday through Friday from 8:00 AM to 4:30 PM. A continental breakfast will be served in the morning, and light refreshments will be available during the day. Knowledgeable tour guides and hosts will be on hand to answer your questions on the highlights and sights of Orange County.

Disneyland Convention Special: Enjoy a day of rides and fun at Disneyland at a reduced price — \$35.00 for adults, \$30.00 for children age 3-11; both prices include meal vouchers worth \$7.55. (Regular admission, \$38.00, does not include food.) Tickets are good for any one day during Microwave Week. Bring the whole family! Children age 2 and under are admitted free.

Tours: Several interesting and appealing tours have been arranged for spouses and guests. All tours depart from the Hospitality Suite on a comfortable coach. Return times have been scheduled to allow for evening activities. As the tours involve varying degrees of walking, comfortable shoes are advised. Tour Tickets and a complimentary Guest Badge will be included in the registration packets of those who have preregistered for the Symposium. The Guest Badge allows access to the exhibits and the plenary session. Because all tours are sold on a first-come, first-served basis, we recommend that you sign up using the advance registration.

SUNDAY, JUNE 13 GETTY CENTER
9:30 AM-3:30 PM **COST: \$30 PER PERSON (LUNCH NOT INCLUDED)**

Join us at the Getty Center, Los Angeles's newest cultural and architectural landmark. Discover the Getty's memorable works of art, from illuminated manuscripts of the Renaissance to 19th Century American photography to van Gogh's *Irises*. Enjoy views of Los Angeles from the mountains to the downtown skyline to the sea. A number of dining options, indoor and out, with a range of menus and prices is available. Maximum: 50 participants.

SUNDAY, JUNE 13 HUNTINGTON LIBRARY,
9:30 AM-3:30 PM **GALLERIES AND BOTANICAL GARDENS**
COST: \$30 PER PERSON (LUNCH NOT INCLUDED)

The exhibits at the Huntington art galleries in Pasadena include the famous Gainsborough *Blue Boy* and Lawrence's *Pinky*, as well as works by Reynolds, Van Dyck and Constable. The library displays many original manuscripts and rare books, one of which is a complete Gutenberg Bible. The Huntington also has 207 acres of magnificent gardens, including a wonderful Japanese garden. Guests can purchase lunch on site.

MONDAY, JUNE 14 MISSION SAN JUAN CAPISTRANO
9:00 AM-3:30 PM **AND LAGUNA BEACH**
COST: \$55 PER PERSON (LUNCH INCLUDED)

We will have a docent-guided tour of this famous California Mission, known as the "Jewel of the Missions." The Mission's original chapel, built in 1777, is the oldest building in California. After lunch in Laguna Beach, there will be time to stroll through the galleries, artisans' studios and boutiques for which the town is famous. The magnificent natural setting of Laguna Beach has attracted artists and poets since the turn of the century. Whether you want to buy or just look, the galleries offer a pleasant excursion.

TUESDAY, JUNE 15 SENSATIONAL LONG BEACH
9:30 AM-3:30 PM **COST: \$55 PER PERSON (LUNCH INCLUDED)**

Long Beach is experiencing a true Renaissance. The opening of the 150,000-square-foot Aquarium of the Pacific has brought about

this rebirth. Enjoy a docent-guided tour of the Aquarium and experience the marine life of the Pacific Rim. We will enjoy lunch at a seafood restaurant in Seaside Village, a short walk from the Aquarium, situated right at the harbor. The afternoon continues with a 45-minute narrated cruise of Long Beach Harbor, one of the busiest ports in the world.

WEDNESDAY, JUNE 16 NIXON PRESIDENTIAL LIBRARY
9:30 AM-3:00 PM **AND ANTIQUING IN OLD-TOWN ORANGE**
COST: \$50 PER PERSON (LUNCH INCLUDED)

Join us for a visit to the Richard M. Nixon Library and Memorial. The Nixon boyhood home is here, as are the graves of President and Mrs. Nixon. From the library, we will travel to Old-town Orange where the Plaza is surrounded by authentic Victorian architecture and charming shops. This town, including 1,700 of its buildings, was recently listed on the National Register of Historic Places. We will have lunch at a charming Victorian Manor. After lunch, you will have time to explore some of the 50 antique shops and 10 antique malls.

THURSDAY, JUNE 17 FROM BOWERS TO FLOWERS
10:00 AM-3:00 PM **COST: \$50 PER PERSON (LUNCH INCLUDED)**

The Bowers Museum of Cultural Art collects and preserves the indigenous fine art of Oceania, the Americas, Africa and the Pacific Rim. Artifacts date from 1500 BC to mid-20th Century. The Bowers was voted one of the country's ten "must see" museums. After leaving the Bowers, we will visit the Sherman Foundation Gardens. We will then enjoy a gourmet box lunch at Corona del Mar's Inspiration Point, with a view encompassing Newport Coast to the north and the Laguna Mountains to the south. There will be time to walk down to the beach and dip your toes into the ocean or to stroll along Ocean Avenue enjoying the views and looking at luxurious homes.

TRAVEL TO ANAHEIM

Air Travel: United Airlines is the official airline of IMS '99. Call United's Specialized Meeting Reservations Center at (800) 521-4041 and use Meeting ID Number 523HU. You may choose a five percent discount on any United domestic published airfare or a 10 percent discount on the unrestricted midweek coach fare. Receive an additional five percent discount on tickets purchased at least 60 days in advance of travel. Or you may choose Area Pricing, a fixed airfare rate to your meeting based on geographical location. Area Pricing must be purchased at least seven days in advance. These discounts apply on United Airlines, Shuttle by United and United Express. Reservationists are on duty seven days a week, 7:00 AM to 12:00 midnight EST. Book early to take advantage of promotional fares that give you the greatest discount.

Rental Car: Avis and Alamo will offer a 10 percent discount on a car rental when booked in conjunction with your airline reservation through United Airlines' Specialized Meeting Reservation Center.

Transportation:

Los Angeles International Airport (LAX) is the major international gateway into Southern California. It is located 31 miles (50 km) and approximately 50 minutes from Anaheim. All major US and international carriers fly into LAX. Call (310) 646-5252 for more information.

Ontario International Airport (ONT) is located 27 miles (42 km) and approximately 45 minutes from the Anaheim area and is serviced by Air LA, Alaska, America West, American, Delta, Northwest, Southwest, United and USAir. Call (909) 937-2700 for more information.

John Wayne/Orange County Airport (SNA) is located 16 miles (42 km) and approximately 25 minutes from Anaheim and is serviced by American, Continental, Delta, TWA and United. Call (714) 252-5200 for more information.

Airport Shuttle: SuperShuttle will provide transportation between Anaheim area hotels and nearby airports. The fares are Los Angeles Airport (LAX), \$13 per person; Ontario International Airport (ONT), \$12 per person; and John Wayne/Orange County Airport (SNA), \$10 per person. Advanced reservations are recommended; call (714) 517-7700 (LAX or SNA) or (909) 467 9600 (ONT).

Taxi: Approximate fare for up to four persons from LAX, \$70; from ONT, \$62; from SNA, \$18.

Advance Conference Registration

1999 IEEE MTT-S MICROWAVE WEEK EVENTS

June 13-19, 1999 ♦ Anaheim, CA ♦ IMS ♦ RFIC ♦ ARFTG

Each Conference Attendee must submit a separate registration form.
A copy of this form may be used. The deadline for advanced registration is May 14, 1999.
Afterwards, on-site fees will apply and will be approximately 30% higher.

NAME		Last		First	
AFFILIATION		Company, Etc.		Mail Stop	
ADDRESS		Street		City	
		State		Postal Code	
		Country		e-mail Address	
US/CANADA TEL.		INT'L TEL.			
IEEE MEMBER		☐ No ☐ Yes ☐ IEEE Membership No.*		MTT-S MEMBER ☐ Yes ☐ No	
Name of Guest				ARFTG MEMBER ☐ Yes ☐ No	

*Must be given to qualify for member discount

For a complimentary badge for plenary session and exhibits

To register, check ☒ the appropriate boxes and enter corresponding fees in the Remittance column.
ONLY PAID ATTENDEES WILL BE ADMITTED TO THE WORKSHOPS AND TECHNICAL SESSIONS.

INT. MICROWAVE SYMPOSIUM (INCLUDES EXHIBITS.)

	IEEE Member	Non Member	Remittance
Mon., Tue., Wed. & Thur.			
All IMS Sessions (Includes IMS CD ROM and Digest.)	☐ \$235	☐ \$340	\$ _____
All IMS Sessions (Includes IMS CD ROM, no Digest.)	☐ \$205	☐ \$310	\$ _____
Single-Day Registration	☐ \$105	☐ \$150	\$ _____
(Includes IMS CD ROM, no Digest.)			
Student, Retiree, Life Member	☐ \$ 35	☐ \$ 50	\$ _____
(Includes IMS CD ROM, no Digest.)			
RFIC SYMPOSIUM (INCLUDES EXHIBITS.)	☐ \$ 85	☐ \$110	\$ _____
Sun., Mon. & Tue. (Includes RFIC Reception and RFIC Digest.)			
ARFTG-AUTOMATIC RF TECHNIQUES CONFERENCE (INCLUDES EXHIBITS.)			
Thur. & Fri. (Includes breakfast, lunch, ARFTG Digest and ARFTG Exhibition.)			
ARFTG Member	☐ \$130		\$ _____
ARFTG Non-member	☐ \$155		\$ _____
ARFTG Student, Retiree	☐ \$ 65		\$ _____

ADDITIONAL DIGESTS AND CD ROMS

(For pickup on-site only. Separate Digests and CD ROMs will be available after the Symposium from the IEEE.)

IMS Digest	Qty. ____ @	☐ \$50	☐ \$70	\$ _____
IMS CD ROM	Qty. ____ @	☐ \$20	☐ \$30	\$ _____
RFIC Digest	Qty. ____ @	☐ \$35	☐ \$50	\$ _____
ARFTG Digest				
Member	Qty. ____ @	☐ \$20		\$ _____
Non-member	Qty. ____ @	☐ \$45		\$ _____

PANEL SESSIONS (Fee is for box lunch. See reverse side for schedule.)

PMOA: Highly Linear High Efficiency Power Amplifiers for Mobile Handsets - Fact or Fantasy?	☐ \$15	\$ _____
PTUB: Starting an Engineering Business	☐ \$15	\$ _____
PWEC: Balancing Technical and Business Concerns: Can Engineers Put Business Types in Their Place?	☐ \$15	\$ _____
PWED: Open Framework Architectures for the Next Decade of Microwave Computer Aided Design	☐ \$15	\$ _____
PTHE: Planning for the High Data-rate Communications Era	☐ \$15	\$ _____
RUMP SESSION (Tuesday evening)	☐ \$10	\$ _____
EXHIBITS ONLY	Qty. ____ @	☐ \$10 \$ _____
DISNEYLAND PASSES adult	Qty. ____ @	☐ \$35 \$ _____
(one-day pass) child	Qty. ____ @	☐ \$30 \$ _____
AWARDS BANQUET	Qty. ____ @	☐ \$40 ☐ \$60 \$ _____

(Wednesday evening, Marriott - Guest prices are same as attendee prices.)

WORKSHOPS (See back of this page for titles.) For paid attendees only.

	IEEE Member	Non Member	Student/Retiree/Life Member
Full Day	\$80	\$105	\$55
Half Day	\$50	\$65	\$35
SUNDAY			
☐ WSFA (Full Day)	\$ _____	☐ WFFM (Full Day)	\$ _____
☐ WSFB (Full Day)	\$ _____	☐ WFFN (Full Day)	\$ _____
☐ WSFC (Full Day)	\$ _____	☐ WFFO (Full Day)	\$ _____
☐ WSFD (Full Day)	\$ _____	☐ WFFP (Full Day)	\$ _____
☐ WSFE (Full Day)	\$ _____	☐ WFFQ (Full Day)	\$ _____
☐ WSFF (Full Day)	\$ _____	☐ WFFR (Full Day)	\$ _____
☐ WSHG (Morning)	\$ _____	☐ WFFS (Full Day)	\$ _____
☐ WSHH (Morning)	\$ _____	☐ WFFT (Full Day)	\$ _____
☐ WSHI (Morning)	\$ _____	☐ WFFU (Full Day)	\$ _____
☐ WSHJ (Afternoon)	\$ _____		
☐ WSHK (Afternoon)	\$ _____		
☐ WSHL (Afternoon)	\$ _____		
		Total for all WORKSHOPS	\$ _____

Full-day workshops include continental breakfast, lunch and afternoon refreshments.
Morning workshops include continental breakfast and lunch.
Afternoon workshops include lunch and afternoon refreshments.
Workshop presenters' notes will be distributed near the registration area.

GUEST PROGRAMS (See page 2 for complete information.)

GA: Getty Center (limit 50)	Qty. ____ @	☐ \$30 \$ _____
(Sun., 9:30 AM-3:30 PM)		
OK to substitute Huntington if Getty is full?	YES ☐ NO ☐	
GB: Huntington Gardens and Museum	Qty. ____ @	☐ \$30 \$ _____
(Sun., 9:30 AM-3:30 PM)		
GC: Mission San Juan Capistrano & Laguna Beach	Qty. ____ @	☐ \$55 \$ _____
(Mon., 9:00 AM-3:30 PM)		
GD: Long Beach Aquarium & Harbor Cruise	Qty. ____ @	☐ \$55 \$ _____
(Tue., 9:30 AM-3:30 PM)		
GE: Nixon Library & Antiquing in Old-town Orange	Qty. ____ @	☐ \$50 \$ _____
(Wed., 9:30 AM-3:00 PM)		
GF: Bowers Museum & Sherman Gardens	Qty. ____ @	☐ \$50 \$ _____
(Thur., 10:00 AM-3:00 PM)		

The only acceptable forms of payment are check, money order, MasterCard or VISA.
Make your check or money order (US \$ ONLY on a US Bank or Traveler's Check) payable to:
"IMS Registration" ■ Or charge your MasterCard or VISA:

☐ MasterCard ☐ VISA

Card # _____
Signature _____

Exp. Date _____

Written requests for a refund will be honored if received by May 14, 1999.
A \$25 cancellation fee will be charged for processing.

TOTAL REMITTANCE \$ _____
INDIVIDUAL PAYMENT MUST ACCOMPANY FORM

MAIL COMPLETED FORM AND PAYMENT TO:

1999 IMS Registration, PO Box 414054, Boston, MA 02241-4054, USA • FAX: (781) 828-9992.

For information or phone registration call (888) 397-6208 or (781) 821-6738.

If this form is sent by FAX do NOT also mail; a credit card number & signature, or a check or money order in US dollars, must be included.

PLEASE FAX OR MAIL; DO NOT FORWARD HARD COPY IF FAXED

REGISTRATION IS ALSO AVAILABLE ON THE WORLD WIDE WEB AT www.expo-intl.com/shows/mtt-s/register

WORKSHOPS

	Number	Time	Title
Sunday June 13	WSFA	8:00 AM-5:00 PM	The One-chip Radio...Search for the Holy Grail?
	WSFB	8:00 AM-5:00 PM	Microwave and mm-wave Design Tool Applications on Virtual Prototyping and Experimental Verification of Integrated T/R Modules
	WSFC	8:00 AM-5:00 PM	Measurement for Wireless Front End Technologies
	WSFD	8:00 AM-5:00 PM	Novel Methodologies for Device Modeling and Circuit CAD
	WSFE	8:00 AM-5:00 PM	Nonlinear Modeling and Characterization of Microwave Devices
	WSFF	8:00 AM-5:00 PM	MMIC Flip Chip Technology, Manufacturing and Use
	WSHG	8:00 AM-12:00 PM	Impact of ATM on Ptop and Ptop Microwave Systems
	WSHH	8:00 AM-12:00 PM	Cryogenic Wafer Probing of Microwave Devices
	WSHI	8:00 AM-12:00 PM	High Resolution Multi-GSPS Analog to Digital Converters for Photonic Systems
	WSHJ	1:00 PM-5:00 PM	High Speed Mixed Mode ICs for Optical Networks
	WSHK	1:00 PM-5:00 PM	State of the Art in Microwave Photonic Components
	WSHL	1:00 PM-5:00 PM	Filters for the Masses
Friday June 18	WFFM	8:00 AM-5:00 PM	Advances in Mixed Electromagnetic Field & Circuit Simulation
	WFFN	8:00 AM-5:00 PM	Microelectromechanical Devices for RF Systems: Their Construction, Reliability and Application
	WFFO	8:00 AM-5:00 PM	An Introduction to the Theory and Practice of Numerical Electromagnetics
	WFFP	8:00 AM-5:00 PM	Recent Advances in Printed Circuit Antenna Technology for Wireless Communications
	WFFQ	8:00 AM-5:00 PM	Ultra High Speed Cryogenic Circuits
	WFFR	8:00 AM-5:00 PM	The Emergence of New Microwave Systems above 45 GHz
	WFFS	8:00 AM-5:00 PM	Technologies for the Next Millennium
	WFFT	8:00 AM-5:00 PM	Photonics in Onboard Active Phased Array Antennas for Communication Satellites
	WFFU	8:00 AM-5:00 PM	Advances in Ceramic Interconnect Technology for Wireless RF and Microwave Applications

PANEL SESSIONS

Monday	PMOA	12:00 PM-1:15 PM	Highly Linear High Efficiency Power Amplifiers for Mobile Handsets - Fact or Fantasy?
Tuesday	PTUB	12:00 PM-1:15 PM	Starting an Engineering Business: The Road to Fortune or Failure
Wednesday	PWEC	12:00 PM-1:15 PM	Balancing Technical and Business Concerns: Can Engineers Put Business Types in Their Place?
Wednesday	PWED	12:00 PM-1:15 PM	Open Framework Architectures for the Next Decade of Microwave Computer Aided Design
Thursday	PTHE	12:00 PM-1:15 PM	Planning for the High Data-rate Communications Era

RUMP SESSION

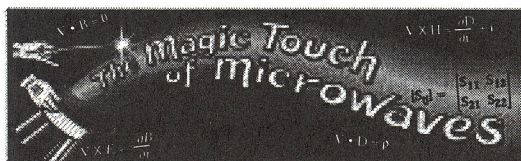
Tuesday		8:00-10:00 PM	Access to MCM-D Packaging Technology
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SOCIAL EVENTS

Wednesday		7:30-10:00 PM	Awards Banquet
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GUEST PROGRAMS

Sunday	GA	9:30 AM-3:30 PM	Getty Center (limit 50)
Sunday	GB	9:30 AM-3:30 PM	Huntington Library, Galleries and Botanical Gardens
Monday	GC	9:00 AM-3:30 PM	Mission San Juan Capistrano and Laguna Beach
Tuesday	GD	9:30 AM-3:30 PM	Sensational Long Beach
Wednesday	GE	9:30 AM-3:00 PM	Nixon Presidential Library and Antiquing in Old-town Orange
Thursday	GF	10:00 AM-3:00 PM	From Bowers to Flowers



CONFERENCE HOUSING

1999 IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM

June 13-19, 1999 • Anaheim, CA

MTT-S • RFIC • ARFTG



Reservations may be made **only by fax, mail or on-line** and must be received by the Housing Bureau by May 24, 1999.

Phone: (Inquiries Only)

(714) 765-8868

Fax:

(714) 776-2688

Mail:

Anaheim Housing Bureau
PO Box 4270
Anaheim, CA 92803

On-line site:

<http://www.anaheimoc.org/housing.html>
Convention Code: MICRO

INSTRUCTIONS AND HOUSING BUREAU POLICY

1. Please print or type all data requested.
2. Reservations will be processed on a first-come, first-served basis.
3. All reservations require a deposit of first night room plus 15% tax paid by check or guaranteed by credit card.
4. Fax and e-mail reservations must provide credit card information. Checks provided for mail reservations should be made out to Anaheim Housing Bureau.
5. You will receive an acknowledgment of your reservation from the Housing Bureau 7-10 days after your reservation is received.
6. Changes and cancellations prior to May 24 must go through the Housing Bureau.
7. Changes after May 24 must be made with your hotel.
8. Hotel cancellation policies vary. Generally, cancellations received by hotels at least 72 hours prior to scheduled arrivals qualify for deposit refunds, but you should check with your hotel to verify its policy.

HOTEL PREFERENCE

Hotel locations and rates are shown on the reverse side of this form.

Please write full name of hotel and show at least three choices.

First choice _____ Third choice _____

Second choice _____ Fourth choice _____

If hotel choices are unavailable, which is most important: Rate _____ or Location _____ (please select one)

Name _____
First Last

Company _____

Address _____

City _____ State/Province _____ ZIP/Postal Code _____

Country _____ Daytime Phone () _____ or FAX () _____
w/Int'l Country Code

Deposit paid by: ☐ Check or Money Order ☐ MasterCard ☐ Visa ☐ American Express

CARDHOLDER NAME (printed) _____

CARDHOLDER SIGNATURE _____

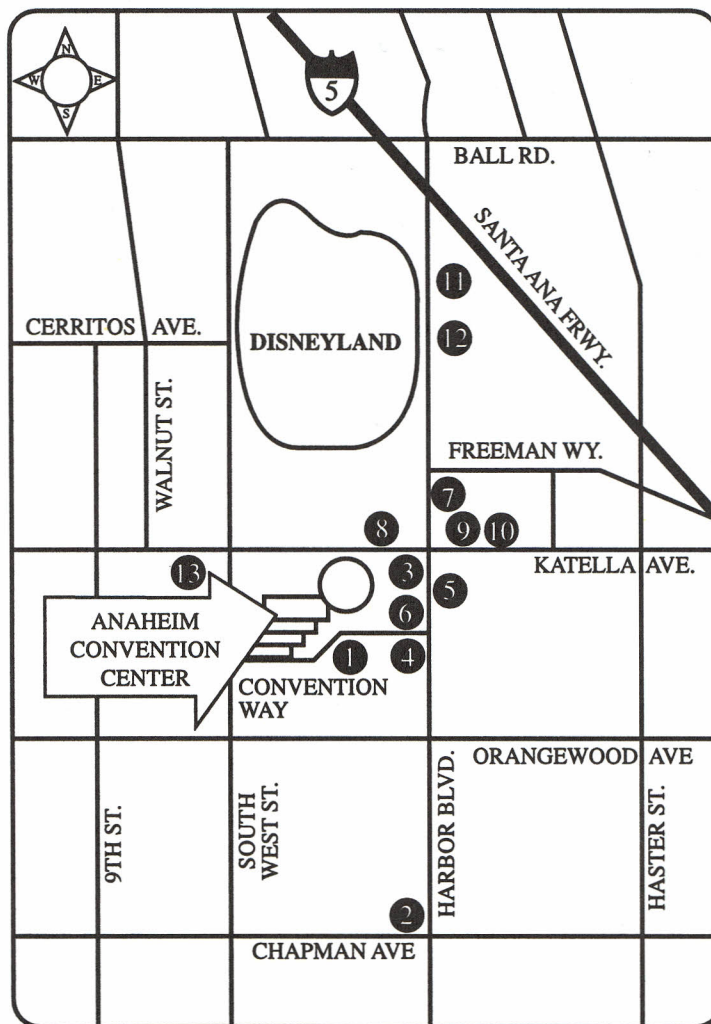
CARD NO. _____ EXP. DATE _____

ROOM OCCUPANTS

1. Print or type names of persons occupying each room. If more than three rooms are required, attach a list providing the information requested below for each additional room.
2. Select room type desired, indicate arrival and departure dates, and special requests (not guaranteed).

Occupants (first name first)

ROOM NO.	1.	2.	Check one: ☐ Single ☐ Double (1 bed) ☐ Dbl/Dbl (2 dbl beds) ☐ Govt. Arr. Date: _____ Dep. Date: _____ Requests: ☐ Smoking ☐ Non-Smoking ☐ Wheelchair Accessible ☐ King
ROOM NO. 1			
ROOM NO. 2			
ROOM NO. 3			



1999 IMS CONFERENCE HOTELS

MAP No.	HOTEL	SINGLE	DOUBLE
1	ANAHEIM MARRIOTT HOTEL (HEADQUARTERS)	\$138	\$138
2	HYATT REGENCY ALICANTE	\$109	\$109
3	JOLLY ROGER HOTEL	\$ 95	\$105
4	QUALITY HOTEL MAINGATE	\$112	\$132 (SUITE)
5	RADISSON HOTEL MAINGATE	\$105	\$105
6	WESTCOAST ANAHEIM HOTEL	\$111	\$111
7	CASTLE INN AND SUITES	\$ 72	\$ 92 (SUITE)
8	DESERT PALM INN & SUITES	\$ 79	\$ 99 (SUITE)
9	FOUR POINTS BY SHERATON	\$100	\$100
10	HOLIDAY INN EXPRESS	\$ 82	\$ 82
11	HOWARD JOHNSON HOTEL	\$ 84	\$ 84
12	BEST WESTERN PARK PLACE INN	\$ 85	\$ 85
13	BEST WESTERN STOVALL'S INN	\$ 75	\$ 75

1999 IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM/MICROWAVE WEEK

		MORNING		LUNCHTIME	AFTERNOON		EVENING
SESSION TIME		8:00-9:40 AM	10:10-11:50 AM	12:00-1:15 PM	1:20-3:00 PM	3:30-5:10 PM	
Sat., June 12		Registration 2 to 8 PM					
Sunday, June 13		Registration 7 AM to 9 PM					
		WSFA: The One-chip Radio...Search for the Holy Grail?					
		WSFB: Microwave and mm-wave Design Tool Applications on Virtual Prototyping and Experimental Verification of Integrated T/R Modules					
		WSFC: Measurement for Wireless Front End Technologies					
		WSFD: Novel Methodologies for Device Modeling and Circuit CAD					
		WSFE: Nonlinear Modeling and Characterization of Microwave Devices					
		WSFF: MMIC Flip Chip Technology, Manufacturing and Use					
	WSHG: Impact of ATM on Ptop and Ptop Microwave Systems		Workshop Lunch 12 to 1 PM	WSHI: High Speed Mixed Mode ICs for Optical Networks		RFIC Reception 7 to 10 PM MARRIOTT	
	WSHH: Cryogenic Wafer Probing of Microwave Devices	WSHK: State of the Art in Microwave Photonic Components					
	WSHL: High Resolution Multi-GSPS Analog to Digital Converters for Photonic Systems	WSHL: Filters for the Masses					
Monday, June 14		Registration 7 AM to 5 PM					
		RFIC Symposium 8 AM to 5 PM - MARRIOTT					
	Room A1	MO1A: Devices for Signal Generation and Amplification	MO2A: Microwave Oscillators	PMOA: Highly Linear High Efficiency Power Amplifiers for Mobile Handsets - Fact or Fantasy? MARRIOTT	MO3A: Microwave Digital Circuits	MO4A: Frequency Control Circuits	Microwave Journal/MTT-S Reception 6 to 8 PM ANAHEIM CONVENTION CENTER
	Room A9		MO2B: Low Noise Components and Design Techniques		MO3B: Microwave Hybrid Technology	MO4B: Very High Power Components and Applications	
	Room A10		MO2C: Millimeter Wave Mixer and Multiplier Technology		MO3C: Millimeter Wave Amplifiers and Sources	MO4C: HF/VHF/UHF Power Amplifiers	
	Room A8	MO1D: Modeling and Analysis of Generalized Networks	MO2D: Neural and Distributed Models for Microwave Circuits		MO3D: Optimization and Neural Network Techniques	MO4D: Simulation Techniques for CAD	
	Room A9	MO1E: Surface and Leaky Waves on Printed Circuits	MO2E: Novel Field Techniques		MO3E: Commercial Microwave Sensor Technology	MO4E: Advances in Passive Remote Sensing	
Room A10							
Room A8							
Tuesday, June 15		Registration 7 AM to 5 PM					
		RFIC Symposium 8:30 AM to 5 PM - MARRIOTT; IMS Exhibition 9 AM to 5 PM; μ APS 12 to 5 PM					
		Student Paper Competition, 3 to 5 PM - ARENA					
		TUF1-TUF4: Interactive Forum, 2:30 to 5 PM - ARENA					
	Room A1	TU1A: Nonlinear MOS and HBT Modeling	PMTUB: Starting an Engineering Business: The Road to Fortune or Failure MARRIOTT	TU3A: Large Signal FET Modeling for Power Amplifier for Mixer Design	TU4A: Interconnects and Transitions	Rump Session: Access to MCM-D Packaging Technology 8 to 10 PM MARRIOTT	
	Room A9	TU1B: High Density Subsystem Packaging Technologies		TU3B: Spatial Power Combining	TU4B: Phased Array and Active Antennas		
	Room A10			TU3C: Technologies for RF Millimeter Wave Applications	TU4C: GaAs Technology and Applications		
Room A8	TU1D: Millimeter Wave Applications	TU3D: Biological Effects and Medical Applications					
Room A9	TU1E: Low Noise MMICs (Joint IMS/RFIC)	TU3E: Terabit Technology for the 21st Century					
Room A10							
Wednesday, June 16		Registration 7 AM to 5 PM					
		IMS Exhibition & μ APS 9 AM to 5 PM					
		WEF1-WEF3: Interactive Forum, 2:30 to 5 PM - ARENA					
	Room A1	WE1A: Passive Structures	WE2A: Advances in Nonlinear Design and Simulation Techniques	PWEC: Balancing Technical and Business Concerns: Can Engineers Put Business Types in Their Place? PWED: Open Framework Architectures for the Next Decade of Microwave Computer Aided Design MARRIOTT	WE3A: Power Amplifier Devices and Technology for Wireless Applications	WE4A: Device Technology for Power Amplifiers	Industry-hosted Cocktail Reception 6 to 7:30 PM MARRIOTT Awards Banquet 7:30 to 10 PM MARRIOTT
	Room A9	WE1B: Focused Session: Optical Processing of Microwave Signals	WE2B: Microwave Photonic Components		WE3B: Optically Controlled Array Antennas	WE4B: Fiber Fed Wireless Access Systems	
	Room A10	WE1C: Filters-Network Theory	WE2C: Filters with Novel Resonator Structures		WE3C: Planar and Coaxial Filters	WE4C: Active and MEMS Filters	
	Room A8	WE1D: Submillimeter Wave and Terahertz Technologies	WE2D: Microwave Communications Systems for Y2K and Beyond		WE3D: Ferrite Devices and Characterization		
Room A9	WE1E: High Power Transistor Amplifiers for X through Ka Band	WE2E: Processing Technologies for the 21st Century	WE3E: Southern California Historical Firsts in Microwave Systems				
Room A10							
Thursday, June 17		Workshop Registration 7 to 5 PM					
		IMS Exhibition & μ APS 9 AM to 3 PM					
		THF1-THF5: Interactive Forum, 2:30 to 5 PM - ARENA					
	Room A1	TH1A: Integrated Subsystems for Wireless	TH2A: Intelligent Transportation Systems	PTHE: Planning for the High Data-rate Communications Era MARRIOTT	TH3A: Sensor Applications	TH4A: Frequency Domain Numerical Techniques II	
	Room A9	TH1B: Novel Transition Structures	TH2B: Micromachined Components		TH3B: Passive Circuit Elements	TH4B: Couplers and Baluns	
	Room A10				TH3C: Microwave Measurement Technology	TH4C: Automated Characterization Techniques (Joint IMS/ARFTG)	
	Room A8	TH1D: Microwave Acoustic Applications	TH2D: Superconducting Components and Technology		TH3D: Frequency Domain Numerical Techniques I		
Room A9	TH1E: New Techniques in Time Domain Modeling	TH2E: Advances in Time Domain EM Field Analysis	TH3E: Signal Generation and Control Devices				
Room A10							
Friday, June 18		Workshop Registration 7 to 9 AM					
		ARFTG Conference & Exhibition 7:30 AM to 5 PM - WESTCOAST ANAHEIM					
		WFFM: Advances in Mixed Electromagnetic Field & Circuit Simulation					
		WFFN: Microelectromechanical Devices for RF Systems: Their Construction, Reliability and Application					
		WFFO: An Introduction to the Theory and Practice of Numerical Electromagnetics					
		WFFP: Recent Advances in Printed Circuit Antenna Technology for Wireless Communications					
		WFFQ: Ultra High Speed Cryogenic Circuits					
		WFFR: The Emergence of New Microwave Systems above 45 GHz					
		WFFS: Technologies for the Next Millennium					
		WFFT: Photonics in Onboard Active Phased Array Antennas for Communication Satellites					
		WFFU: Advances in Ceramic Interconnect Technology for Wireless RF and Microwave Applications					

1999 IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM

Anaheim, CA • June 13-19, 1999

ADVANCE PROGRAM

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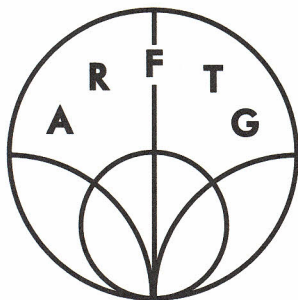


<http://www.mtt.org/ims1999>

June 1999 IEEE MTT-S International Microwave Symposium Week

ACTIVITY	LOCATION	SUN/13				MON/14				TUE/15				WED/16				THU/17				FRI/18			
		M	N	A	E	M	N	A	E	M	N	A	E	M	N	A	E	M	N	A	E	M	N	A	E
IMS	Technical Sessions																								
	Workshops																								
	Plenary Session																								
	Interactive Forum																								
	Student Paper Contest																								
	Panel Sessions																								
	Rump Session																								
Exhibits																									
	μAPS																								
RFIC	Technical Sessions																								
	IMS Joint Session																								
	Interactive Forum																								
	Workshop																								
	Panel Session																								
ARFTG	Workshop																								
	IMS Joint Session																								
	Conference																								
	Exhibits																								
Social	Workshop Bkfst, Lunch																								
	MTT Members Bkfst																								
	RFIC Reception																								
	MJ Reception																								
	Industry Reception																								
	MTT Awards Banquet																								
	Speakers Breakfast																								
	ARFTG Breakfast																								
	ARFTG Awards Lunch																								

ACC = Anaheim Convention Center



Automatic RF Techniques Group 53rd Conference • Nonlinearity Characterization Anaheim, California • June 17-18, 1999

FINAL CALL FOR PAPERS

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In conjunction with the 1999 IEEE MTT-S International Microwave Symposium (IMS), the Automatic RF Techniques Group will hold its 53rd ARFTG Conference in Anaheim, Calif. on Thursday and Friday, June 17-18, 1999. The program will feature joint ARFTG/IMS sessions on Thursday and a one day conference on Friday devoted to techniques for quantifying and describing nonlinear effects in RF devices, circuits, and systems.

We invite you to submit a paper on RF and microwave measurements to our 53rd ARFTG Conference. We particularly seek original papers that address issues in nonlinearity characterization for RF communication systems, such as:

- digital mobile
- LMDS, MMDS & other Broadband Wireless Access Systems
- digital cable and broadcast television
- LEO and other satellite communication systems
- wireless local loop
- wireless LAN

Contributed papers can focus on nonlinear measurement requirements and methods, instrumentation, model parameter extraction, model verification through measurements, performance results, and general nonlinear analysis in communication systems. Papers are also invited in other areas of automated microwave and RF measurements, including network analysis, calibration techniques, on-wafer measurements, power, and noise.

Deadlines

Feb. 26, 1999

Mar. 26, 1999

Abstract and Summary Deadline

Full Paper Deadline

Please note these new preselection and CD-ROM deadlines.

Instructions to Authors

Contributed papers will be presented as 20 minute talks or in an interactive poster session, and published in both the 53rd ARFTG Digest and the 1999 International Microwave Symposium CD-ROM. We request authors to submit a one page abstract and a 500 to 1000 word summary, including illustrations, to allow for evaluation with regard to the interests of the participants and the quality and novelty of the work. Please make your submission electronically to the Technical Program Chair following the *Abstract/Summary Submission Instructions* found on our conference Web site, <http://www.arftg.org>.

Authors of accepted papers must submit their full publication electronically for inclusion in both the CD-ROM and printed digest. If your paper is accepted, you will be invited to submit an extended version for publication in the Special Symposium Issue of the *IEEE Transactions on Microwave Theory and Techniques*. For further details on electronic paper preparation and submission, please read the *Instructions for Authors* found on our Web site.

Exhibits

The 53rd ARFTG Conferences also offers an outstanding exhibition opportunity. Please contact our Exhibits Chairman directly for further information.



www.arftg.org



William C. Brown: A Few Introductory Comments

by Peter Staecker,
for the Awards Committee

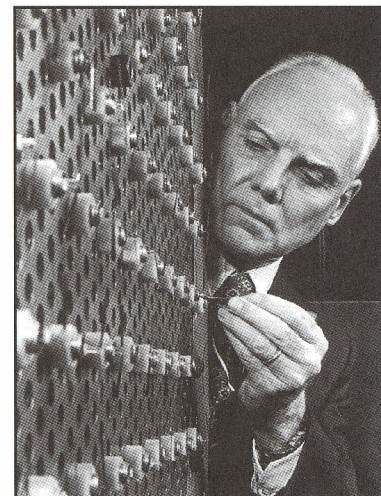
This year's recipient of the MTT-S Career Award is Bill Brown. He is the first in our Society to have been awarded both the Microwave Pioneer Award (1995) and the Career Award, and is therefore a man of exceptional talent and accomplishment.

For further details on Bill Brown the engineer, we invite you to read the comments of John Osepchuk, which were delivered at Bill's Memorial Service in Weston, MA on February 7, 1999. He uses the word *shepherd* to describe Bill's role in growing the magnetron group to international prominence, and *visionary* to characterize his pioneering inventions and demonstrations in the area of wireless power transmission.

Dick Dickinson, in summarizing these achievements in somewhat more detail, characterizes Bill as a *phenomenal builder with analytic skills*. And indeed he was, sometimes even at the expense of his wife Marge's kitchen sink, as he perfected some early experiments on what we later would associate with the science of printed circuit processing technology.

Finally, in the words of Bill himself, we gain some insight into how he began to assemble the skills that would guide his career, as a teenager in Lewis, Iowa.

A few other things about Bill: He was a track and football athlete as a young man. When he moved to New England he constantly tested his strength on the trails in the White Mountains, and passed his passion for the outdoors to his family and friends. He was a loving husband and fa-



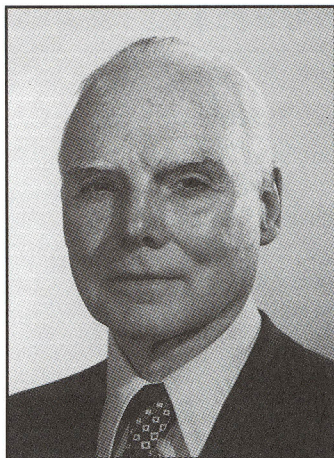
Bill Brown tunes a rectenna array.

ther. He was a teacher. He leaves a legacy of achievement and a challenge for further work. We should listen. 

William C. Brown: 1916-1999

Excerpts from a eulogy

by John Osepchuk (F '78)¹ on February 7, 1999



William C. Brown, Jr.

It is my honor to speak today on behalf of Bill's colleagues, both at Raytheon and in

his profession. This is an opportunity for us to recognize Bill as a great engineer with pioneering contributions, but also to express our warm remembrances of his character and personality. Finally we want to acknowledge Bill's visionary role in the technology of microwave power applications. We hope we can help advance this field building on the foundation that Bill and others have created.

The obituary in yesterday's Globe was an excellent summary of a 60 year career which started when Norman Krim hired Bill at Raytheon from MIT. Soon Bill was a key aide to the legendary Percy Spencer. Together they learned to manufacture the thousands of magnetrons that were the heart of radar - the technology which Buder² credits

for changing the world. After the War, Bill built a magnetron development laboratory where many (probably in the hundreds) of us were hired. Good engineers with names like Derby, Kather, Geier, Clampitt, Smith and many others thrived under Bill. His honesty, fairness and unfeigned passion for solving engineering problems gained the admiration and respect of all. He rose to the rank of Assistant Vice President. A key achievement was the invention of the crossed-field amplifier (CFA). So devoted was Bill to the success of this new device that he voluntarily relinquished his managerial position to shepherd engineering work, which led to the use of the CFA in the Apollo lunar module as well as the Patriot ground radar. For these advances Bill received the MTT-S Pioneer Award in 1995.

¹ John Osepchuk, MTT-S National Lecturer (1977-78), and Fellow, International Microwave Power Institute (1978), is with Full Spectrum Consulting, Concord, MA.

² Buder, Robert, "The Invention That Changed the World: How Small Group Radar Pioneers Won the Second World War and Launched a Technical Revolution," Touchstone Books (1998).

Less recognized has been Bill's visionary role in the field of microwave-power applications - e.g. heating and other non-communications uses. In taking on this role, Bill helped advance Percy Spencer's vision of the microwave oven and those of industrial applications, spearheaded by George Freedman and Richard Edgar. The inter-disciplinary intercourse required for such applications—e.g. between an engineer and a cook, was not deemed suitable by the IEEE. Therefore, Bill and a few others founded the International Microwave Power Institute (IMPI) in the mid-sixties. Shortly thereafter, Amana opened the successful microwave oven market.

Bill recognized the potential role microwaves could play in the "solar power satellite", an idea invented by Dr. Peter Glaser to help solve the energy crisis. He then collaborated with Peter, Owen Maynard and others in NASA on design and advanced development of a system which would beam to earth five billion watts, enough for a large city. A key device, called the "rectenna", was invented by Bill to make this power transmission efficient. For economic reasons, funding for the SPS was shelved but world-wide activity on the SPS and related MPT (microwave-power transmission) ideas never ceased and is now resuming within NASA. A book ed-

ited by Dr. Glaser³ that chronicles these developments was dedicated to Bill.

Bill as a visionary, dedicated his later life to the advancement of this technology. His family and wife certainly supported him. I remember at his retirement party in 1984 that Wes Teich from the podium told Bill that his daily life would change upon retirement, but Marge spoke up to say to the contrary, that come Monday morning, Bill would still go to work. Indeed, for 7-8 years thereafter Bill consulted at Raytheon. In his last years Bill still worked in his home laboratory. Bill worked to advance microwave-power transmission through committees of the IEEE and IMPI, and various professional meetings, mostly at his own expense. He conducted demonstrations of microwave power transmission at meetings, at social occasions at my home and in the Museum of Science for Australian TV.

In the last two years when Bill anticipated his passing, he took steps to pass on his documents and equipment. Major contributions were made to ongoing work on microwave power transmission at universities in Alaska and Texas. Last week in a telephone discussion with Tom Ruden, Bill stressed the importance of continuing theoretical magnetron studies.

On Monday, Peter Glaser visited and had a fruitful chat. Bill was a worker to the end.

I said that Bill was a visionary. He was not always applauded for his visions. Neither were Peter Glaser with his idea of beaming microwaves to earth from space or Professor Pound of Harvard who proposed microwave heating of people as one way of solving the energy crisis. Bill did find one unexpected ally in the famous Russian physicist, Piotr Kapitsa. In the early eighties, after relaxation had begun in the Soviet Union, Kapitsa was able to visit MIT, where he made the following prophecy related to SPS aspirations:

"It is worth noting, that, before electrical engineering was pressed into service by power engineering, it was almost exclusively occupied with electrical communication problems (telegraphy, signaling and so on). It is very probable that history will repeat itself. - At present, electronics is used mainly in radio communication, but its future lies in solving major problems in power engineering."

As a Christian, I feel confident that Bill is in the good hands of the Almighty. We hope Bill will look down and see his visions come true. 

3 Glaser, Peter E., Davidson, Frank Paul, and Csigi, Katinka I. (editors), "Solar Power Satellites: A Space Energy System for Earth," Wiley Praxis Series in Space Science and Technology (1998).

Bill Brown's IEEE MTT Career Award

by Richard M. Dickinson, JPL

Some of the following materials were graciously provided to me by one of Bill Brown's four Daughters, Donna Salisbury via fax on Feb 11, 1999. Also, according to the Brown Family, Bill was working up until his death on Feb 3, 1999. Bill was 82 and knew of his pancreatic cancer for 18 months and beat the predicted life span by about a year.

In 1998, Bill had asked me to receive for him the IEEE MTT Career award to be presented at MTT-S in Anaheim in June of 1999, as he knew he probably could not travel. I agreed to do so, and offered to assist him in writing or otherwise aiding him

in putting together any materials that would be appropriate for the event.

I will put in electronic form the autobiography he provided me and the unfinished materials he was writing regarding his career. I will then add my own comments concerning his career and the award.

First, Bill's own words:

"Every career involves a unique series of events that taken together determine that career. This article is a compilation of the events in my life that led to the microwave contributions for which I have been honored by the 1999 Microwave Career Award. It goes without saying, of course,

that these contributions could not have been made without the contributions of many other individuals and that a good part of my own success while I was in a management role was in recognizing these contributions and putting them to good use.

On the other hand a good part of my success lay in a more solo role in times when there was not adequate support for what I was endeavoring to do and when I resorted to the machine shop and electronics lab that I had in my own home to carry on and bridge these gaps in support. At times, this home equipment and my ability to use it had enormous leverage. This genetically inspired drive to build things is perhaps the most unique quality of my career. For this

reason I will delve back into my younger years to explore its development.

I was born on a farm in Iowa in 1916. I could well have become a farmer but my father unexpectedly died when I was four years old and my mother, sister, and I moved into Lewis, a small town of 500 people and where I attended twelve years of school. I recall that we had a large pile of old lumber and that I spent a lot of time nailing boards together. My first serious project began in the 7th or 8th grade was building a bird house for Martins. Now Martin birdhouses are large houses and have to be supported on sturdy towers. I will always be grateful to my mother for allowing me to build it in the parlor of our home. We took the tower out of one of the windows in the parlor.

Just before my Sophomore year in high school the Fisher Body Corp. of General Motors sponsored a country wide contest for young people to build the best scaled replica of the coach that Napoleon used at his marriage to Marie Louise of Austria. This caught my attention and I purchased the blue prints and the construction kit for \$5.00 which consisted of blocks of wood, cans of paint, etc. The scaled replica was enormously complex. I started from scratch, and there were no real mentors in the town to help me. I had to assemble some tools for this job, one of which was a \$6.00 wood lathe from Sears Roebuck, a Jig saw, etc. But I won first place in the state of Iowa for the coach that I entered. I entered the same coach with some improvements the following year and won again. By my Senior year in high school I had fo-

cused on building a coach that would Z-1) win the national prize which was \$5,000, money enough at that time to pay for a four year Z.' attendance at M.I.T. I thought I had an approach that would do it.

The coach, and especially the wheels, were covered with hundreds of ornaments of about 11 six different designs. Common approaches to reproduce these such as casting did not give the desired detail of the design and led to a certain crude appearance of the whole coach. So I read some place about a process in which a master with great detail was hand tooled and then repetitively pressed into a flat plate of bees wax that had been previously coated with graphite. After that the bees-wax plate was inserted in an electroplating solution and copper plated.

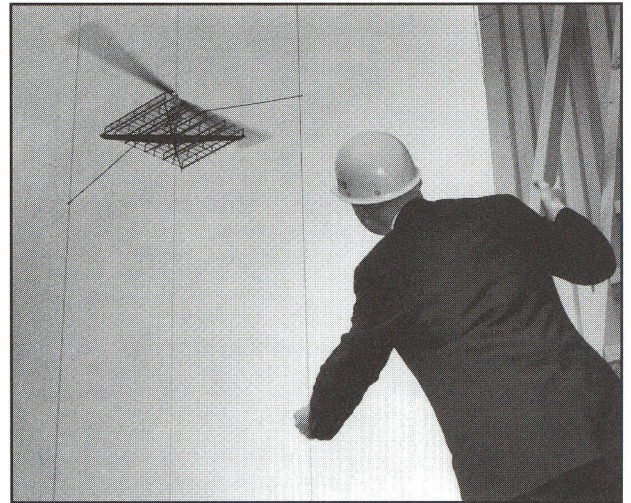
After removing the copper plated sheet from the plating bath and cutting around the perimeter of each ornament, each reproduced unit looked like the original. These ornaments added greatly to the finished appearance of the coach. Knowing that no other contestant would probably use this approach and having an otherwise high quality coach I thought I had a good chance at the grand prize.

But I was to be disappointed in winning the national prize and had to be satisfied with the State prize again. However, I obtained a lot of good experience, including keeping my nose to the grind wheel. During the year I spent 1200 hours during the last six weeks of the contest I worked eighteen gained reason"

(Ed. note, end of transcription material)

Autobiography

William C. Brown received the B.S.E.E. from Iowa State University in 1937 and the M.S.E.E.



1964: Bill Brown with tethered helicopter having a payload of rectenna elements to convert microwave power to dc power. He took a course on servomechanisms at Northeastern University to properly design the system, and said it was the "hardest course I ever took."



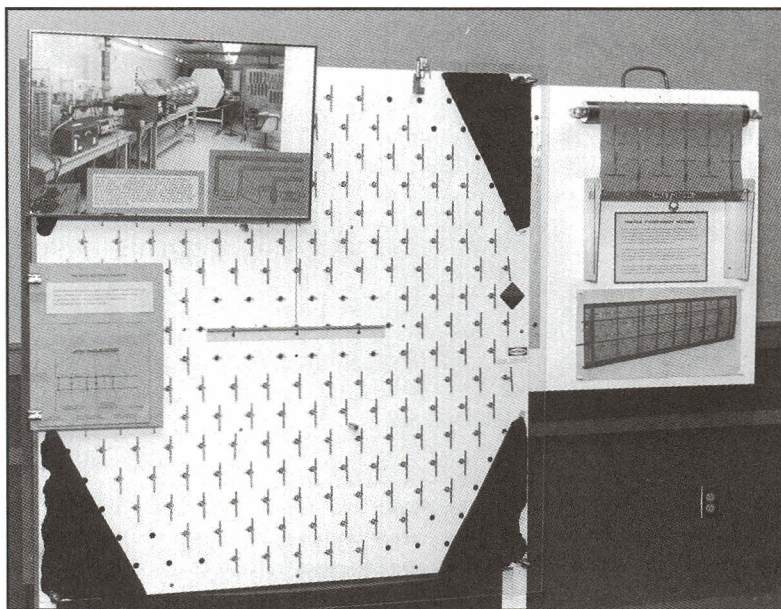
Bill watches the helicopter in flight. Stabilization wires pass through the center of the helicopter and through the ends of two outrigger rods. The demonstration lasted 10 hours with the helicopter hovering at an altitude of 60 ft.



March 1954: Bill Brown, Assistant VP, Raytheon, shows amplifier technology to visiting Air Force officials. L/R: William Welsh, Raytheon, Dr. James A. "Jimmy" Doolittle, Assistant to Chief-of-Staff, USAF; Bill Brown; Lt. General Donald Putt; Percy Spencer.

from M.I.T in 1941. He is a Life Fellow of the IEEE.

He joined the Raytheon Co. in 1940, and became involved in making improvements in the design of magnetrons that were used in all World War II microwave radars. However, magnetrons are oscillators and were not suitable for the next generation of radars that needed an efficient, high powered and broadband amplifier. In 1952 he made a major contribution in fulfilling that need by converting the magnetron os-



1975: The rectenna shown was used in the microwave power transmission test certified by JPL quality assurance personnel, demonstrating 54% dc-dc power efficiency. The test set up consisted of a microwave oven magnetron which fed power to a dual mode horn to produce a gaussian beam, and collected by the rectenna to convert to dc again. A printed film version of the rectenna is displayed to the right of the 3D array. This implementation illustrates a low-cost and conformal version of the antenna suitable for underwing aircraft application

cillator into a broadband amplifier. This device, variously referred to as the *Platinotron*, *Amplitron* or simply as the crossed-field amplifier (CFA) found immediate military and civil usage. These applications included the Navy Aegis radar, the Hawk and Patriot Missile Systems, commercial air route surveillance radar, and the high rate communications

system in the Apollo lander that sent televised images from the Moon to Earth. For this contribution Mr. Brown received the MTT-S Pioneer Award in 1995.

Mr. Brown then proposed that the CFA be developed into a super power amplifier and the resulting DOD contract produced a CFA that generated 425 kW of continuous

power with an efficiency of 76% at the frequency of 3 GHz. This represented a power increase by two orders of magnitude.

He then proposed the use of microwaves for WPT or Wireless Power Transmission, and wrote the first published article that explored the possibilities in 1961. Then, under an Air Force contract he demonstrated in 1964, on the CBS Walter Cronkite News, a microwave powered helicopter that received all the power needed for flight from a microwave beam. Key to this flight was the "rectenna" which was invented to absorb the microwave beam and simultaneously convert it to DC power.

Key to future applications of WPT is the overall efficiency or ratio of DC power output to DC power input. In the 1969 to 1975 time period, Mr. Brown managed a program that increased the overall efficiency, or ratio of DC power out to DC power in, to a JPL certified efficiency of 54%, several times greater than generally expected. He was also technical director of a JPL Raytheon program that beamed power over a distance of one mile to a rectenna which intercepted a portion of the beam and converted it to 30 kilowatts of DC power with 84% efficiency

Mr. Brown formally retired from Raytheon in 1984 but continued there as a consultant. Four volumes of his papers have been preserved in the MTT-S Museum in Baltimore. These same papers, over 2000 pages of final reports authored by Brown, four IBM-sponsored videotaped lectures at Northeastern University, and numerous historical physical artifacts have been transferred to archives at Texas A&M University. Microwave magnetrons and CFAs are on exhibit in the Raytheon Museum.

Dickinson's Further Comments

Bill Brown's distinguished career created the microwave wireless power transmitting field as we know it today [1]. I believe that in the future through his efforts we will be able to use WPT to reach the stars, by using WPT technology to power photon pushed light sails for interstellar flight from our planetary system.

Bill's career developments in high power microwave generation[2] and efficient rectification [3] were what prompted Peter Glaser[4] to propose the Space Solar



At the Boston Museum of Science, Peter Glaser (Arthur D. Little, Inc.), Bradford Washington (Director, Museum of Science), and Bill Brown field questions on Satellite Power Stations from young scientists.

Power Satellite System or SPS[5], that NASA and DOE studied extensively in the 70s and 80s. This may have prompted Bob Forward[6] to propose a photon pushed lightsail mission to Alpha Centauri in 1984, and a microwave powered version pushed by SPS beamed power in 1985 [7].

Bill's career cut across many microwave activities involving work on cooker tube magnetrons, crossed field devices [8], rectennas and electronically steered phased array modules (ESPAMs). Bill impressed me very much with his ability to do multidisciplinary engineering. He learned to model and analyze control systems for helicopters, to calculate lift and drag forces on helicopters, airplanes and airships, to calculate the thermal heat balances for space objects, etc.

His grasp of Microwave Theory and Techniques was wide-ranging. In addition to designing the antenna, the RF transmission line impedance transformers and the microwave filter circuit design for the rectenna, Bill devised a VSWR probe assembly in front of a rectenna array in order to adjust the DC loads for low reflection impedance matching. He designed and fabricated an expanded waveguide test fixture for measuring the record reception-conversion efficiency of a single rectenna (92.5% at 6W RF input). In a related effort, he devised a split-ground plane assembly for carefully measuring all of the incident and reflected RF, DC output, and dissipated thermal energy in the rectenna diode and skin effect losses to accurately account for all elements of power loss.

Bill designed high power rectennas, very low power density rectennas, light weight rectennas, wafer thin rectennas for integrating into aircraft underwings, low-cost rectennas, and microwave and millimeter wave rectennas. He documented and reported on his work in chapters in Academic Press Electrical Science Series Microwave Power Engineering Books, NASA, Raytheon, and RADC reports. He wrote articles in *The Journal of Microwave Power*, *IEEE Transactions*, *IMPI Journals*, *Conference Proceedings and Reports*, *AIAA Space Solar Power Review*, and appeared in video taped lectures. He demonstrated microwave power generation, transmission and rectification to individuals such

as Werner von Braun, Raytheon & NASA managers, and at diverse venues including MTT-S meetings, science museum audiences, college classes, and private gatherings. As of 1995 he had published over 70 papers and 50 patents in wireless power transmission and microwave tube technology.

Bill was a phenomenal builder equipped with very good analytic skills. In addition to his beautiful Fisher Body Napoleonic coaches, he built helicopter models, dual-mode Potter horns, strip ellipsoidal reflectors, motor-driven Earth globes with GEO SPS supported on beams for science fairs & museums, phase injection -locked magnetrons outfitted with buck-boost coils and variable output tuners for ESPAMs.

It was Bill Brown's vision that the technology of free-space power transmission by microwave or laser beam will inevitably lead to an extension of our two dimensional electric grid system to three dimensions in which electrical power is routinely transmitted to and from space. Bill's career is a model for now and future MTT Members to aspire to. More power to us.

Acknowledgement:

Some of the above material was graciously provided to me by one of Bill Brown's four Daughters, Donna Salisbury via fax on Feb 11, 1999. I want to also acknowledge help from Dr. John Osepchuk of Full Spectrum Consulting, Peter Staecker, and Austin Truitt of MTT for providing some of the information on the career of Bill Brown.

William C. Brown - Honors and Service:

- 1945: Naval Ordnance Development Award
- 1950-1960: Member and later Deputy Director, Advisory Group on Electron Devices (AGED)
- 1947: Presidential Certificate of Commendation
- 1957: Fellow, IRE, "For contributions in the field of microwave tubes"
- 1964: IR-100 Award for super power amplatron (425 kW)

- 1966: Founding member of International Microwave Power Institute
- 1968: DoD Meritorious Civilian Service Award
- 1970: AES Barry Carleton Award (paper on use of microwave beam to power and position a helicopter)
- 1972: Professional Achievement Citation: Iowa State University
- 1978: Fellow, International Microwave Power Institute
- 1982: IR-100 Award for ultra-light printed circuit rectenna
- 1995: MTT-S Pioneer Award for converting the microwave magnetron into a broadband amplifier

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8. Brown, W., "The History of the Crossed-field Amplifier," *IEEE MTT-S Newsletter*, pp. 29-40, Fall 1995. 

Bill Brown: Brief Notes on the Shaping of a Career¹

Every career involves a unique series of events that taken together determine that career. This article is a compilation of the events in my life that led to the microwave contributions for which I have been honored by the 1999 Microwave Career Award. It goes without saying, of course, that these contributions could not have been made without the contributions of many other individuals and that a good part of my own success while I was in a management role was in recognizing these contributions and putting them to good use.

On the other hand, a good part of my success lay in a more solo role in times when there was not adequate support for what I was endeavoring to do. During these times, I resorted to the machine shop and electronics lab that I had in my own home to carry on and bridge these gaps in support. At times, this home equipment and my ability to use it had enormous leverage. This genetically inspired drive to build things is perhaps the most unique quality of my career. For this reason I will delve back into my younger years to explore its development.

I was born on a farm in Iowa in 1916. I could well have become a farmer but my father unexpectedly died when I was four years old and my mother, sister, and I moved into Lewis, a small town of 500 people and where I attended twelve years of school. I recall that we had a large pile of old lumber and that I spent a lot of time nailing boards together. My first serious project began in the 7th or 8th grade was building a bird house for Martins. Now Martin birdhouses are large houses and have to be supported on sturdy towers. I will always be grateful to my mother for allowing me to build it in the parlor of our home. We took the tower out of one of the windows in the parlor.

Just before my Sophomore year in high school the Fisher Body Corp. of General

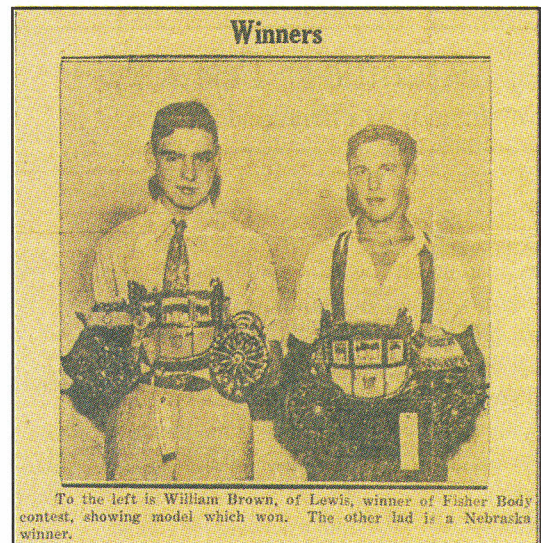
Motors sponsored a country wide contest for young people to build the best scaled replica of the coach that Napoleon used at his marriage to Marie Louise of Austria. This caught my attention and I purchased the blue prints and the construction kit for \$5.00 which consisted of blocks of wood, cans of paint, etc. The scaled replica was enormously complex. I started from scratch, and there were no real mentors in the town to help me. I had to assemble some tools for this job, one of which was a \$6.00 wood lathe from Sears Roebuck, a jig saw, etc. But I won first place in the state of Iowa for the coach that I entered. I entered the same coach with some improvements the following year and won again. By my Senior year in high school I had focussed on building a coach that would win the national prize which was \$5,000, money enough at that time to pay for a four year attendance at MIT I thought I had an approach that would do it.

The coach, and especially the wheels, was covered with hundreds of ornaments of about six different designs. Common approaches to reproduce these such as casting did not give the desired detail of the design and led to a certain crude appearance of the whole coach. So I read some place about a process in which a master with great detail was hand tooled and then repetitively pressed into a flat plate of bees wax that had been previously coated with graphite. After that the beeswax plate was inserted in an electroplating solution and copper plated.

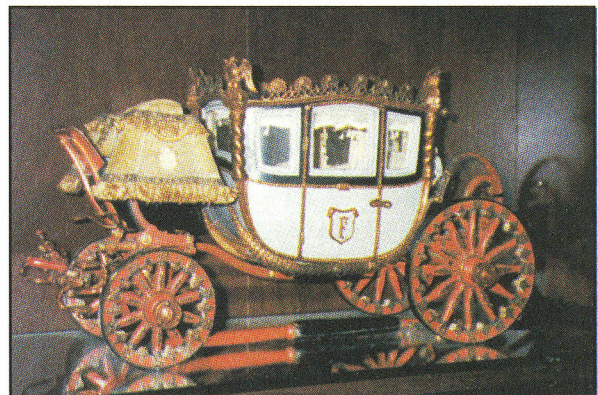
After removing the copper plated sheet from the plating bath and cutting around the

perimeter of each ornament, each reproduced unit looked like the original. These ornaments added greatly to the finished appearance of the coach. Knowing that no other contestant would probably use this approach and having an otherwise high quality coach I thought I had a good chance at the grand prize.

But I was to be disappointed in winning the national prize and had to be satisfied with the State prize again. However, I obtained a lot of good experience, including keeping my nose to the grind wheel. 



Clipping from the Lewis, Iowa newspaper on the occasion of Bill's success in the Fisher Body contest.



A photograph of Bill's model of the Napoleonic Coach.

¹These autobiographical notes by Bill are the opening remarks of an article he was writing for this Newsletter. The effort was cut short when he passed away on February 3, 1999, but even this brief look at his early years, the integrity, persistence and focus of Bill's approach are unmistakable. — Peter Staecker

A report on the XXVIII Moscow International Conference on Antenna Theory and Technology

Dr. Eli Brookner,
Raytheon Company,
E-mail:
Eli_Brookner@notes.res.ray.com

This exciting conference was held September 22-24, 1998, in the suburbs of Moscow, about 65km from Moscow center, at a summer resort. Some of the Russian papers given were:

1. The Russian 7.2 (23.6 ft.) diameter 35GHz limited-scan high power (up to 10MW) phased array planned for use for tracking earth debris (presented by A. A. Tolkachev, Chairman of the Conference and Technical Director at Radiophysika in Moscow).

2. The joint Russian/South-Korean direct broadcast satellite (DBS) van mounted antenna for receiving direct broadcast satellite (DBS) TV signals. This antenna uses one-dimensional electronic scanning in elevation with 360 of mechanical rotation (presented by Dr. Alexander Shishlov, Conference Vice-Chairman and at Radiophysika, Moscow).

3. Phase-Only Adaptive Array Processing (presented by Dr. A. D.

Khzmalyan of the State Research Institute, Altair, Russia).

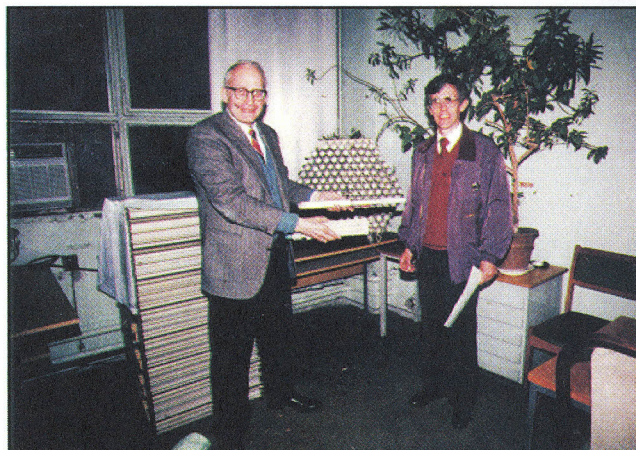
4. Phase Only Control of the Spectrum of a Train of Pulses (presented by Dr. A. D. Khzmalyan).

5. A Lunar Power Station for directing solar energy to the earth via Rf signals.

6. A limited-scan array antenna using radiating elements having nearly ideal rectangular beam patterns (presented by Dr. S. P. Skobelev, Secretary of Conference Program Committee and at Radiophysika, Moscow).

The following excellent invited papers from non-Russian authors were given:

1. A talk by myself entitled "Phased Arrays: Major Advances and Future Trends Into The Next Millennium". Covered were the new developments that have taken



Dr. Eli Brookner pointing to one of the 0.6m (2 ft.) diameter dish antenna elements of the Russian 7.2m (23.6 ft.) diameter 35GHz limited-scan phased array at Radiophysika, Moscow. To Dr. Brookner's right are Dr. Alexander Shishlov and Dr. V. V. Denisenko both of Radiophysika.

place such as, recent developments in row-column scanning (the continuous transverse stub [CTS] antenna) and the British MMIC MESAR 2 active-array antenna system follow-on work (the MESAR 2 air defense and ballistic defense version and the SAMPSON frigate ground-based 2-faced version).



Gathered around the table displaying ferrite phase shifters at DOMEN, St. Petersburg, are Dr. Andrey V. Nikiforov, V. Federov, Dr. Alexey Y. Kenivets, Oleg V. Trekhovitsky, Dr. Eli Brookner and Prof. Boris M. Lebed. The large phase shifter at the farthest end of the table is the Russian AWACS phase shifter designed by Oleg V. Trekhovitsky. All except Dr. Brookner are with DOMEN.



Dr. Eli Brookner (at left) and Prof. Boris A. Rozanov (head of the department for Electronic Systems and Devices at Moscow State Technical University) standing in front of Russian 7.85m (25.9 ft.) 90GHz radio astronomy antenna 110km from Moscow.



Dr. Eli Brookner giving his invited plenary talk "Phased Arrays: Major Advances and Future Trends Into The Next Millennium" at the XXVIII Moscow International Conference on Antenna Theory and Technology September 22, 1998.

2. A talk by Dr. Manfred Uhlmann of Daimler-Benz Aerospace on The European Strike Fighter Aircraft Active Array Antenna using MMIC T/R modules.

3. A paper by Larry Corey of the Georgia Technology Research Institute on the state-of-the-art of Planar Near-Field Ranges for Characterizing Phased-Array Antennas.

4. A talk by Dr. J. M. Colin of Thomson-CSF in France on the status and new developments of Phased Array Antennas in France.

Also given was an interesting paper by Dr. Naftali Herscovici (Cushcraft Corp., USA) on a microstrip patch radiating element antenna having a 100% bandwidth.

While there I had the good fortune to visit two Russian companies and a Russian radio astronomy station. These were:

1. The impressive Russian 7.85m (25.9 ft.) 90GHz radio astronomy station about 110 km from Moscow center. This radio

telescope is used for monitoring solar 90GHz hot spots.

2. Radiophysika in Moscow where a prototype of the Russian Mints S-band DON-2N anti-ballistic missile (ABM) radar was developed and where the millimeter space-debris radar mentioned above was developed.

3. The Russian ferrite phase shifter company DOMEN located in St. Petersburg. This company developed and built most of the phase shifters used in Russian radars. It built the phase shifter for the ABM radar mentioned above, for the Russian equivalent of our AWACS airborne early warning radar, and the Russian surface over-the-horizon (OTH) radar. They also developed a row-column steered millimeter wave array intended for potential use in a low cost automobile collision avoidance radar.

A total of 144 papers from 17 countries are given in the conference proceedings. Represented at the conference were attendees from Armenia (1), Brazil (1), Byelorussia (2), China (2), Finland (1), France (1), Germany (1), Japan (2), the Netherlands (1), Russia (114), Spain (1), Sweden (1), Taiwan (1), Turkey (2), the Ukraine (9), USA (3), and Yugoslavia (1).

A copy of the 603 page conference proceedings (in English) can be obtained for just \$50 (which includes air-mail postage). Write to Dr. S. P. Skobelev, e-mail: apex@glasnet.ru. 



Dr. Eli Brookner (Raytheon Company) and Dr. V. V. Denisenko (Radiophysika Moscow) are standing in front of prototype of Russian Mints S-band DON-2N anti-ballistic missile (ABM) antenna at Radiophysika in Moscow. Dr. Brookner is holding in his left hand one of its phase shifters. To the left of Dr. Brookner is a prototype of an S-band RF array intended to be used as a weapon. He is holding a phase shifter for this array in his right hand.



Conference attendees at first plenary session

A Report on MSMW'98

The Third International Kharkov Symposium "Physics and Engineering of Millimeter and Submillimeter Waves" (MSMW'98) took place in Kharkov, Ukraine on September 14-18, 1998. It was organized by:

- Usikov Institute for Radiophysics and Electronics of the National Academy of Sciences of Ukraine (IRE NASU)
- Institute of Radio Astronomy of the National Academy of Sciences of Ukraine (IRA NASU)
- Kharkov State University (KSU)
- IEEE AP/ED/MTT/AESS-SS Joint Chapters of Ukraine
- Ukrainian URSI Committee

The holding such a symposium in general would not be possible without a generous support of MSMW'98 sponsors:

- URSI
- IEEE ED and MTIF Societies
- US Army European Research Office
- Science and Technology Center in Ukraine (STCU)

MSMW symposia were held several times in Kharkov since 1978 as a regular Former Soviet Union meeting on MM and SUBMM waves and applications. It became an major event in this area and since 1991 it has been well-known as the International Kharkov Symposium.

Ukraine is located in the center of Europe, being the largest European country in territory, with population of 52 million. The city of Kharkov (population about two million) was founded in 1656 as a frontier site, and has developed into an important industrial, educational, scientific and culture center. It has a large research community and long-standing educational traditions. There are more than 180 scientific institutions, design offices and 21 universities and university-level colleges. The most famous of them is KSU, which is the oldest science university in Ukraine (since 1805) and highly reputed university in mathematical and physical sciences in the Former Soviet Union. MSMW'98 sessions were held in the KSU rooms. Other MSMW'98 Organizers: IRE NASU and IRA NASU are well-known institutions in MM and SubMM wave research and applications. The MSMW'98 International Program Committee included wellknown and respected members of the international microwave community.

Working days of the symposium were September 15 to 17; September 14 was the day of registration, September 18 was filled with social events. Every day the conference started with a plenary session of 40-min invited lectures at a large auditorium. After it, four parallel day-long sessions of 20-min contributed papers had been working. All the papers were presented in English.

The number of registered participants was 148 including 92 from Ukraine; 17 from

Russia, 8 from Germany, 2 from China, 1 from Great Britain, Japan, Belarus, Brazil, Mexico and Turkey, each. Totally 198 papers out of 247 in the Program were presented. Two-volume MSMW'98 Proceedings counting totally over 800 pages have been published before the conference.

September 15.

MSMW'98 started at 8:30 on September 15, 1998 by the opening ceremony at the "New Physical" auditorium of the Kharkov State University (KSU). First to address the participants was MSMW'98 Chairman, Director of the Institute of Radiophysics and Electronics of the National Academy of Sciences of Ukraine (IRE NASU), Vice-Chairman of the Ukrainian National URSI Committee Prof. Vladimir M. Yakovenko. He remarked that Kharkov symposia on millimeter and submillimeter waves have already 20 year history and have gained a high reputation and recognition in the Former Soviet Union (FSU) and worldwide. He was followed by the welcome words from MSMW'98 Co-Chairmen: Director of the Institute of Radio Astronomy of the National Academy of Sciences of Ukraine (IRA NASU), Vice-Chairman of the Ukrainian National URSI Committee Prof. Leonid M. Lytvynenko and Rector of Kharkov State University Prof. Vasiliy A. Svich. They presented to the MSMW'98 participants main scientific developments of Kharkov radiophysicists. The next to make a welcoming speech was Vice-Head



The MSMW'98 opening ceremony.



MSMW'98 Chairman Prof Vladimir M. Yakovenko addressed the participants with the opening words.



The MSMW'98 participants, with the Kharkov State University building in the background.



Prof. Anatoly A. Kirilenko of IRE NASU (Ukraine) tells about the advanced single-pass CAD tools developed by his team for the waveguide circuit design.

of Kharkov State Administration Dr. Valerij F. Mescheryakov. He told to the audience about the city of Kharkov, its historical and cultural heritage. Eventually, Prof. Alexander Nosich of IRE NASU addressed the participants on behalf of the IEEE East Ukraine Joint Chapter of the Antennas & Propagation, Microwave Theory & Techniques, Electron Devices, and Aerospace & Electronic Systems Societies.

On the same morning the first plenary session was held, consisting of three invited talks:

- H. G. Unger, M. Shahabadi, and K. Schijenemann "A Review of the Principles of Holographic Power Combining at Millimeter and Submillimeter Frequency" (*Institut fuer Hochfrequenztechnik, Technische Universitaet Braunschweig, Braunschweig, ** Technische Universitat Hamburg-Harburg, Hamburg, Germany)
- R. Judaschke, K. SchUnemann "InP Transferred Electron Devices for Power Generation at Frequency about 130 GHz" (Technische Universitat Hamburg-Harburg, Hamburg, Germany)
- V.M. Yakovenko "Transition Radiation of Charged Particles and the Possibility of Sub-millimeter Waves Generation in Plasma Like Media" (IRE NASU, Kharkov, Ukraine)

Further, after a coffee break, the conference continued working with four simultaneous sessions:

- B. Electronics of MM and SUBMM waves, including quantum and relativistic electronics
- C. Wave processes in finite-size semiconductors, solid-state structures and HTSC materials
- E. MM and SUBMM wave propagation

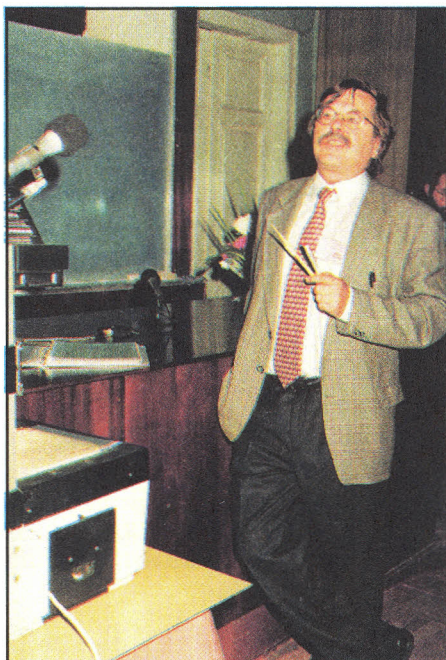


Prof. Hans-Georg Unger of Technical University of Hamburg-Harburg (Germany) talked about some nonstandard approaches in the millimeter wave engineering: Holographic power combining using diffraction gratings.

H. MM and SUBMM devices based on the planar and quasi-optical transmission lines (passive and active components, antennas)

In this sessions, the following session invited papers were presented:

- V.D. Naumenko*, K. SchOnemann**, V.Ye. Semenuta*, D.M. Vavriv*, V.A. Volkov* "MM- Wave Transmitter Using Magnetrons with Cold Secondary-Emission Cathode" (*IRA NASU, Kharkov, Ukraine, ** Technische Universitat Hamburg-Harburg, Hamburg, Germany)
- B.G. Kutuza*, G.K. Zagorin*, A. Schroth", A. Hornbostel** "Value Estimations of the Third Stokes-Vector Component Both Precipitation Microwave Emission and Sun Scattered Radiation Observations" (*Institute of Radio Engineering and Electronics of Russian Academy of Sciences, Moscow, Russia, **DLR, Deutsches Zentrum fuer Luft- und Raumfahrt, Institut fuer Hochfrequenztechnik, Oberpfaffenhofen, Germany)
- A.A. Kirilenko, L.A. Rud', V.I. Tkachenko, L.P Mos'pan, D.Yu. Kulik "Integrated Software Package for Syn-



Prof. Peter Kordog of the Research Center of Juelich (Germany) delivered a talk about new trends in the Ga-As-based devices for generation of millimeter and submillimeter waves.

thesis, Analysis and Optimization of Frequency-Selective Devices of Millimeter and Centimeter Waves" (IRE NASU, Kharkov, Ukraine)

On same evening, at 7:30 p.m., Welcome Party was organized at the university cafeteria. Before it started, MSMW'98 participants were invited for a short visit to the roof out-looking space on top the 14-level main tower of the university building. The September weather was fine and



Prof. Konstantin A. Lukin of JRC-Ispira & IRE NASU (Italy-Ukraine) speaks about the developments of his laboratory in the field of noise radar technology.

allowed enjoying aerial views of the 2-million city, full of green trees and busy streets. At the welcome party, Ukrainian champagne was served. This event created a perfect atmosphere to relax and shake off the troubles of long and sometimes tiresome journeys that participants had to undertake to reach MSMW'98

September 16.

At the conference morning plenary session, the following invited papers were presented:

- G. Duxbury*, K. Smith*, M. McPhail*, R. McPheat*, J. Ballard", and D. Newnham, "The Synergy of Sub-millimeter and Infrared Spectroscopy in Predicting Global Warming Effects of CFC Replacement Molecules" (*Department of Physics and Applied Physics, Glasgow, UK, Molecular Spectroscopy Facility, Rutherford Appleton Laboratory, Oxfordshire, UK)
- P. Kordog "New Trends in GaAs-Based Devices for Generation of MM and SubMM Waves" (Institute of Thin Film Ion Technology, Research Centre Juelich, Juelich, Germany)
- K.A. Lukin "Millimeter Wave Noise Radar Technology" (JRC-Ispira, Italy & IRE NASU, - Kharkov, Ukraine)
- G.P. Kulemin "Remote Estimation of Soil Parameters by Radar Method" (IRE NASU, Kharkov, Ukraine)

This day regular sessions of contributed papers consisted of.

A. New principles of generating and receiving MM and SUBMM waves

D. Problems of the theory of wave diffraction

F. Communications and radars; remote sensing

L. Biomedical applications of MM and SUBMM waves

In the session F, session following invited paper was presented:

E.P. Kropotkina, A.N. Lukin, S.B. Rozanov, S.V. Solomonov "Remote Sensing of the Atmospheric Ozone at Millimeter Waves" (P.N. Lebedev Physical Institute of Russian Academy of Sciences, Moscow, Russia)

On the same evening, the conference banquet was held at the university cafeteria. This was a lovely event accompanied with live music, dancing and speeches. The dominant tone, however, was the joy of meeting the old friends and colleagues and making new ones.

September 17.

On the third day, the morning session looked as follows:

- L.V. Lubyako, E.V. Suvorov, A.V. Burov, A.M. Shtanuk, Yu.A. Dryagin, L.M. Kukin, N.K. Skalyga "Detection Systems for the Measurement of Collective Thomson Scattering in Fusion Plasmas" (Institute of Applied Physics of Russian Academy of Sciences, Nizhny Novgorod, Russia)
- V. N. Balabanov, E.M. Ganapolskij, A.V. Golik, V.M. Efimov, A.P. Korolyuk, A.C. Kurekin, A.G. Sergeev, V.V. Tarakanov, and V.N. Tsymbal "Hypersonic Delay Lines: Physical Base, Technology and Using in the Space Radar Engineering" (IRE NASU, Kharkov, Ukraine)

Parallel sessions of regular papers that day went along the following topics:

G. MM and SUBMM wave radio astronomy

I. MM and SUBMM wave spectroscopy



At the banquet, the music plays so loudly that Prof. Ame F. Jacob Technical University of Braunschweig (Germany) has to switch to near-zone communications with Irina A. Tischenko, charming PR officer of symposium



Symposium banquet was a memorable evening of Ukrainian foods and music in the university restaurant. Prof. Boris I. Makarenko of Scientific-Research Institute of Radio Engineering Measurement (Ukraine) proposes a toast for the millimeter and submillimeter waves.

J. MM and SUBMM wavelength instrument-making for scientific research (hot-plasma diagnostics, control of technological processes)

K. Electromagnetic metrology

In this sessions, following session invited papers were presented:

- V.M. Shulga*, I.I. Zinchenko** "Millimeter and Submillimeter Wave Spectroscopy of Interstellar Medium" (*IRA NASU, Kharkov, Ukraine, "Institute of Applied Physics of Russian Academy of Sciences., Nizhny Novgorod, Russia)
- B.A. Rozanov*, S.B. Rozanov** "Low-Noise Millimeter and Submillimeter Wave Receivers" (*Moscow State Technical University, Moscow, Russia, ** P.N. Lebedev Physical Institute of Russian Academy of Sciences, Moscow, Russia)
- A.F. Krupnov, M.Yu. Tretyakov, V.N. Markov, E.N. Karyakin, G.Yu. Golubyatnikov, V.V. Parshin S.A. Volokhov, , A.M. Shitov, V.V. Bichkov, I.I. Leonov "Precise Measurement in MM and Sub-MM-Wave Range Based on Phase-Locked Primary Radiation" (Institute of Applied Physics of Russian Academy of Sciences, Nizhny Novgorod, Russia)
- V.V. Meriakri "Materials Properties in Near Millimeter Wave Range" (Institute of Radio Engineering and Electronics of Russian Academy of Sciences, Fryazino, Moscow Region, Russia)
- Yu. V. Bykov, A.G. Ereemeev, V.V. Holoptsev, K.I. Rybakov, V.E. Semenov "Processing of Materials Using Millimeter-Wave Radiation" (Institute of Applied Physics of Russian Academy of Sciences, Nizhny Novgorod, Russia)
- M. Wollitzer*, J. Buechler*, J.-F. Luy**, U. Siart*, and J. Detlefsen "MM wave Radar Sensor for Vehicle Applications" (*Diemler-Benz Forschung Ulm, Ulm, Germany **Lehrstuhl für Mikrowellentechnik, Technische Universität München, München, Germany)
- A.S. Kleiman "The Elaboration Measurement Accuracy Problems of the Frequency Characteristics of the Sources of High Stability Oscillations in the Millimeter and Submillimeter Range and of the Means of their Traceability" State Scientific-Industrial Association "Metrology", Kharkov, Ukraine)
- Rolf Judaschke (Technische Universität Hamburg-Harburg, Hamburg, Germany)
- Michael Wollitzer (Diemler-Benz Forschung Ulm, Ulm, Germany)
- Koki Watanabe (Kyushu University, Fukuoka, Japan)
- Alexander Zamyatin (Moscow Institute of Physics and Technology, Dolgoprudnyi, Moscow Region, Russia)
- Kirill Rybakov (Institute of Applied Physics of Russian Academy of Sciences, Nizhny Novgorod, Russia)
- Vladimir Tkachenko (KSU, Kharkov, Ukraine)
- Andrey Serebryannikov (IRA NASU, Kharkov, Ukraine)
- Andrey Andrenko (IRE NASU Kharkov, Ukraine)

Each MSMW'98 award consisted of a colorful certificate signed by the MSMW'98 Chairman and a bottle of Crimean champagne.

Final closing address was done by Prof. Vladimir M. Yakovenko. He informed the audience that, in all, the number of registered participants was 147. Unidentified number of non-registered participants was estimated as around 50, mainly from Kharkov universities and research establishments. Of 247 papers included into the MSMW'98 Program, 205 had been pre-

The closing ceremony of MSMW'98 took place in the "New Physical" auditorium of KSU at 5:30 p.m. Finally, several awards of the conference were announced and handed to the awardees.

Eight MSMW'98 awards "In recognition of remarkable presentation at the young scientists paper competition" went to the following young scientists:

sented according to the preliminary information. After that, Vladimir M. Yakovenko announced that the next Symposium, MSMW'2001, will be held most probably again in Kharkov in 2001, thanked the organizers for creating an unprecedented forum for scientific discussions and expressed a hope that MSMW series will continue.

September 18.

After closing of the MSMW'98, the participants were proposed a dense social program in order to get relaxed after three days of intensive work and strengthen the links originated at the symposium. On Fri-

day, September 18, a field trip was organized to the UTR-2 Observatory of the IRA NASU. This world-largest decimeter wavelength radio telescope is located about 80km southwards from Kharkov. After visiting radio telescope a barbecue party was held.

We hope that The Third International Kharkov Symposium "Physics and Engineering of Millimeter and Submillimeter Waves" aroused a great interest and had such a favorable impression on research community that the* participants will remember it for long and have a strong desire to visit the future Kharkov MSMW in the next millennium.

Alexei A. Koostenko
MSMW'98 Co-Organizer

Alexander I. Nosich
East Ukraine IEEE
AP/MTT/AES/ED Chapter Secretary
MSMW'98 Co-Organizer

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Radio Frequency Principles and Applications: The Generation, Propagation, and Reception of Signals and Noise

by Albert A. Smith, Jr.,
IEEE Press/Chapman &
Hall Publishers
Series on Microwave Technology
and RF,
1998, xiv + 219 pages, \$55.00, ISBN
0-7803-3431-0.

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Appendix A	Physical Constants
Appendix B	Electrical Units
Appendix C	Wave Relations
Appendix D	Math Identities
Appendix E	Vector Operators
Appendix F	Frequency Bands

This book is intended primarily for practicing engineers engaged in prediction and measurement of electromagnetic fields and their effects. Engineers who are not experts in electromagnetic theory, but work in related fields, such as electromagnetic compatibility (EMC), radio wave propagation, antennas, wireless communications, and microwaves, will find the book particularly useful and easy to read. The book is probably not suitable as a textbook for a course because it does not include mathematical derivations or problems. However, the book does contain a number of informative practical examples in line with the applications intent of the author.

Even though the treatment of most topics is fairly short and concise, the book includes a number of important, practical topics that cannot be found in classical textbooks on electromagnetics and anten-

nas. For example, Chapter 4 on Antennas does a nice job of defining and relating the large number of terms (effective length, antenna factor, directivity, gain, effective aperture, etc.) used to describe antenna performance. I can still remember being puzzled over the term "antenna factor" when I entered the EMC field and could not find the term in my antenna books. The chapter also describes four antenna calibration methods for measuring antenna factor. Similarly, Chapter 5 on RF Environment does a good job of explaining various noise parameters and related antenna and receiver noise terms that can confuse the nonspecialist. I also enjoyed the historical paragraphs on the pioneers of electromagnetics (Maxwell, Faraday, Lorentz, Ampere, etc.).

In summary, the author has succeeded in writing a useful, practical, easy-to-read book on electromagnetic applications to a variety of areas. The book is strongest in EMC applications, but will also be useful for engineers in other popular areas, such as wireless communications and microwaves.

Reviewed by:

David A. Hill
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Review of recent books on active arrays, quasioptical systems and spatial power combiners

by Michael Steer

The last ten years have seen rapid development in the ability to manipulate propagating microwave and millimeter-wave signals. The impetus for this work was the need to develop high power microwave and millimeter-wave sources using solid state devices. Radar, roughly, require power levels of 1 kW at 10 GHz, 100 W at 35 GHz and 10 W at 100 GHz. Omnidirectional communication systems need powers about an order of magnitude lower. The required powers cannot be delivered using solid-state transistors or

MMIC's, even if a few, say four, are combined. Traveling wave tube amplifiers can provide these power levels, and more, have, but together with the substantial power supplies required have severe size, weight, and lifetime problems.

Around one hundred MMIC's need to be combined to achieve the high power levels. Typically conventional output combining (or power combining) uses binary trees of microstrip circuitry where the outputs of pairs of MMIC's are combined, then pairs of these combinations are combined and so on until a single electrical

output results. This approach is impractical when more than say 4 MMICs are combined because of losses in each of the combining stages and, more importantly, the severe matching problems the occur. Possible solutions include the development of higher power solid state sources and the development of new architectures for combining power. Spatial power combining is the promising new architecture. In this architecture signal from each of a large number of sources radiate power into a propagating mode. Then, hopefully, the signals from each source combine coherently and without loss. This is very similar

to the operation of phased array radars. The crucial difference is that in phased array radar there is high isolation between the active sources and the radiating structures or antennas. In spatial power combining systems there is very little isolation (essential for efficient power generation) so that the system is really an active array.

Spatial power combining is the topic of four recent books:

1. *Integrated Active Antennas and Spatial Power Combining*. John Wiley & Sons, 1996 by J.A. Navarro and K Chang, ISBN 0-471-04984-0.

2. *Active and Quasi-Optical Arrays for Solid-State Power Combining*. John Wiley & Sons, 1997 Edited by Robert York and Zoya Popovic, ISBN 0-471-14614-5.

3. *Quasioptical Systems: Gaussian Beam Quasioptical Propagation and Applications*. IEEE Press, 1998 Paul Goldsmith, ISBN 0-7803-3439-6.

4. *Active antennas and Quasi-Optical Arrays*. IEEE Press, 1999 Edited by Amir Mortazawi, Tatsuo Itoh and James Harvey, ISBN 0-7803-3486-8.

These are all good books with very little overlap. In terms of conceptual development the book by Paul Goldsmith is the first in this series. The term quasioptical refers to a mode family properly referred to a quasi-optical beam modes. The mode system that describes the propagation of a laser beam. Quasi-optical modes form a complete (ortho-normal) system for beams traveling along an axis but without boundaries to confine the beam. All of the modes have an overall gaussian shape. As with other mode systems plain wave, metal (waveguide, etc.) each mode has a unique propagation characteristics.

Lenses and mirrors can be used to periodically refocus quasioptical modes and so coherently propagate signals and thus power. This is an essential aspect of quasi-optical systems and spatial-power combining systems the coherent illumination of devices and the coherent combining of signals radiating from an antenna array. Paul Goldsmith focuses on a complete investigation of systems using unbounded quasi-optical electromagnetic propagation. There is a complete description of quasi-optical signal propagation; Gaussian beam transformation (e.g. lenses and mirrors); Gaussian beam coupling for axially aligned and offset beams; antenna feed systems for generating and collecting quasi-optical beams; and the design of quasi-optical components such as polarizing grids, absorbers, loads interferometers, filters and resonators; and imaging arrays. At the end he touches on active quasi-optical systems including amplifiers, oscillators, mixers and phase shifters.

In systems where the electromagnetic signal is confined by metal walls, it is not correct to use the term quasi-optical as the signals do not propagate in a quasi-optical mode (which have infinite extent transverse to the direction of propagation). It is more appropriate to use the term spatial as in spatial power combining or spatially distributed systems. The next three books in the series deal with spatial power combining systems. The emphasis is overwhelmingly on power combining. In the first half of their book, Julie Navarro and Kai Chang present material of a general microwave nature which builds up the fundamentals behind the design of spatial power combiners. The general topics include oscillator fundamentals, antenna elements, general power-combining

methods. In the second half a few of the spatial power combining systems are sampled. This book was published a little too early to capture the rapid developments of recent years and so important and promising spatial power combining systems are not considered.

In my humble opinion, the best book of the lot is that edited by Robert York and Zoya Popovic with contributions from the leading developers of spatial power combining concepts. The chapters were carefully selected with an effort made to fill in the background gaps in the published literature. The first two chapters present the fundamentals of spatial combiners and for the first lay down a set of performance measures that were agreed on, by consensus, by the practitioners in the field. The remainder of the book covers the major types of spatial power combining systems with an emphasis on the lateral thinking involved in arriving at the different concepts. There is also a good discussion of the design process used in developing the systems. Finally, the book edited by Amir Mortazawi, Tatsuo Itoh, and James Harvey is a volume of selected reprints, 53 in all, with a perspective paper at the beginning with an extensive bibliography. Every major advance in the field is reported on.

As yet spatial power combining has not delivered on its promise to deliver high powers. It is early days yet but at this stage it appears that spatial power combining will not have a role to play below 10 GHz, perhaps higher, because of advances in solid state technology providing discrete transistor solutions.

I am glad that I have all four books as they cover the field with little overlap. 

IEEE Pairs Up With Teachers To Help K-12 Students Learn Technology

Piscataway, NJ, 29 January, 1999 — Fifteen members of the IEEE Pre-College Education Coordinating Committee (PECC), a cross-section of engineers and educators, recently developed a framework for an

IEEE pre-college education initiative. The framework was developed after the committee brainstormed ways in which the IEEE and the engineering community can collaborate with teachers to foster innova-

tive teaching strategies among K-12 science, math, and technology teachers.

Formed in October 1998 at the Technological Literacy Counts workshop in Balti-

more, MD, the PECC is one of the few IEEE committees that actively recruits non-engineers. Pete Lewis, Educational Activities Staff Director, contends, "It's important that the IEEE take an active role in enhancing the technological literacy of K-12 students. We can only do so by listening to the educational needs of those on the front lines, the teachers themselves."

In a round-table discussion format, participants sought to answer the following questions:

In this rapidly growing technology age, WHAT tools/resources do K-12 educators

need in order to most effectively teach their students science, math, and technology subjects?

- As the world's largest technical professional society, HOW can the IEEE, and the engineering community at large, help teachers foster technological literacy among their students?

A participating and appreciative eighth-grade science teacher from Oklahoma said, "I am so glad the IEEE is breaking out of the 'box' and reaching out to teachers." In the coming months, the IEEE will form a specific action plan for its

pre-college education initiative. For more information, contact Barbara Stoler, IEEE Educational Activities, 445 Hoes Lane, PO Box 1331, Piscataway, NJ, 08855-1331; e-mail: b.stoler@ieee.org.

The IEEE is the world's largest technical professional society, serving the interests of more than 330,000 members in the information and electrotechnology communities in approximately 150 countries. In keeping with its "Networking the World" slogan, the IEEE helps to foster technological innovation, enable members' careers, and promote worldwide professional community.

New IEEE Web Site Features Virtual Reading Room

PISCATAWAY, NJ, 3 March 1999 – The IEEE Educational Activities Department announces the release of its Online Education Reading Room at:

<http://www.ieee.org/eab>

Once inside the virtual room, viewers can click on any book in the best-selling IEEE Selected Readings series or *Engineers' Guides To Business Series*, and "flip through" the full text of its pages. Titles up for browsing include *Cellular Radio And Personal Communications*, *Smart Antennas*, *Recent Developments in Power*

Electronics, *Marketing for Engineers*, *Working In A Global Environment*, *Writing For Career Growth*, and more!

Logical and user-friendly in its design, the reading room features:

Keyword, title, and author search options

- Full table-of-contents displays for each title
- Navigation tools that enable viewers to move from page to page and section to section, and to zoom in for a closer look at diagrams and formulas

- Online ordering options

["Having a reading room on the Internet gives visitors the opportunity to browse through books before buying them, just as they would in a traditional bookstore," says Alan Trembly, Business Development Manager for IEEE Educational Activities. "A distribution medium such as this really enhances the IEEE's image as practitioner of the technology of the future."]

For more information about the reading room contact Alan Trembly at a.trembly@ieee.org.

Learn How To Alleviate Software Safety Concerns With A New Video Tutorial From IEEE

PISCATAWAY, NJ, December 1, 1998 - Software safety is an emerging concern in various disciplines such as air traffic, transportation, healthcare, and the military to name a few. Software developers must become cognizant of the developing regulations, processes and tools that will help the developers to successfully build safe and secure software systems.

To help software developers learn how to build safe and secure software systems, IEEE Educational Activities has released a video tutorial *Developing Software for Safety Critical Systems*. The video pro-

vides the user with an overview of software safety regulation activities, as well as the information on processes and tools that assure software safety. In addition, this tutorial covers:

- software's potential dangers
- regulatory efforts
- software product development initiatives to meet critical application needs

This tutorial will serve as an ideal learning tool for those involved in product development containing significant software con-

tents, or those who are involved in developing software applications with potential safety impact to humans or equipment. Software engineers, software developers, managers, and entrepreneurs delivering such products will learn a great deal from this video. It is recommended that viewers possess a basic understanding of software languages and/or programming concepts.

Mike DeWalt, National Resource Specialist with FAA; John F. Besnard of Raytheon Systems Company; and Dr. Jeffrey Voas, Reliable Software Technologies presented the valuable contents for this program. Dr.

Samuel. J. Keene of the IEEE Reliability Society served as a program moderator and technical editor.

This course consists of two videotapes, printed presentation notes, and the text, *Software Fault Injection: Inoculating Programs Against Errors* by Jeffrey M Voas and Gary McGraw.

To order the video, use IEEE product number: NTCS number: HV7016-QVE. PAL number: HV7017-QVE. Member price, \$499. List price: \$562. Order from the IEEE Customer Service, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855-1331, USA. Make checks payable to IEEE. For single sales, call 1-800-678-IEEE; for company or institutional sales, call 1-800-701-IEEE; or fax 732-981-9667.

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IEEE videos include tutorials, short courses, distinguished speaker lectures and conference video proceedings. Topics are at the advanced undergraduate or graduate levels and include published learning objectives, as well as booklets that contain visuals and other information developed to enhance the learning experience. All video products are available in either NTCS or

PAL standard. To order, one must select the standard that is used in the country where the tape will be played. If the individual is unsure about the video standard used in a particular country, he or she can call IEEE customer service.

The IEEE is the world's largest technical professional society, serving the interests of more than 320,000 members in the information and electrotechnology communities in approximately 150 countries. In keeping with its "Networking the World™" slogan, the IEEE helps to foster technological innovation, enable members' careers and promote worldwide professional community. 

1999 Emerging Technology Winter Meeting Digital Receivers and Enabling Technologies

Organized by Tim Kemerley and Karl Varian

On Saturday (January 9, 1999) at the LAX Marriot Hotel the 1999 Emerging Technology Winter Meeting was held. This year's topic was "Digital Receivers and Enabling Technologies", with approximately 60 enthusiastic people in attendance. The meeting consisted of five presentations; subject, author, and an abstract of the presentations (material presented at the meeting is available on the MTT web site, www.mtt.org) follows:

"Introduction and Commercial Usage of Digital Receivers" by Charles Chien (Rockwell). Communications up until the last decade has been predominantly analog. Today, systems built based on analog communications are rapidly being replaced by digital systems. Furthermore, digital systems are finding their way into a growing number of new application areas; especially in the wireless domain. This talk will describe a brief historic perspective on the evolution of digital radio sys-

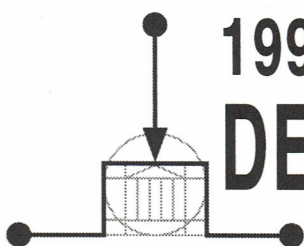
tems and their current as well as future commercial applications.

"High Speed Analog/Digital Converters" by Bob Walden (HRL Labs). Analog-to-digital converters (ADC) are ubiquitous, critical components of signal processing systems. This talk surveys the state-of-the-art for ADCs and includes both experimental converters and commercially available parts. The shape of the distribution on a resolution vs. sampling rate graph provides insight into ADC performance limitations.

"Microelectromechanical Systems" by Al Pisano (DARPA). Microelectromechanical Systems (MEMS) is a new technology that has emerged out of the fabrication tools commonly used by manufacturers of integrated circuits. In this talk, MEMS will be briefly reviewed and then MEMS application to high-performance, low-power, ultra-miniaturized receiver components will be described.

"RF Photonics" by Larry Lembo (TRW). Advances in solid state electronics and crowding of the available RF spectrum both suggest that future military electronic warfare (EW) environments will span an RF spectrum as wide as 100 GHz. This presentation will address the development of analog photonic systems designed to process such large bandwidths, by conditioning them to be interfaced to the evolving electronic digital receiver technologies.

"Digital Receiver Future in Military Electronics" by Jim Tsui (AF/WPAFB). This talk presented wide band receivers for electronic warfare and narrow band receivers for communication applications. Three potential approaches to build wide band receivers will be discussed; multirate, clockless logic and monobit receivers. Software approaches for narrow band receivers will be presented. 



1999 INTERNATIONAL SEMICONDUCTOR DEVICE RESEARCH SYMPOSIUM

December 1-3, 1999 (Prior to the 1999 IEDM Meeting in Washington, D.C.)

EXTENDED ABSTRACT DEADLINE:

August 30, 1999 (Max 4 pp single-spaced text, refs, and figures). Authors of accepted papers will be notified by October 5, 1999.

ORIGINAL PAPERS ARE SOLICITED IN THE FOLLOWING AREAS:

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	Before 11/1/99	After 11/1/99	Amount Enclosed
Registration	\$275	\$300	_____
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Extra Banquet Pass	\$30	\$30	_____
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Register on-line via our web site and fax payment information or mail registration form to Symposium Coordination address.

EXHIBITORS

Vendors are encouraged to register to exhibit. Exhibition rates to reserve a table are given above. Please forward your registration with payment to the Symposium Coordination address.

FOCUS OF THE SYMPOSIUM:

The Symposium will emphasize fundamental concepts in novel devices and advanced processing technologies. The extended abstracts will be afforded a quick review and publication. Participation of students and foreign researchers is strongly encouraged.

ADDRESS CORRESPONDENCE TO:

For technical content questions, please contact the program chairs or co-chairs listed below. For paper submission, 2 copies of the cover letter and 4 copies of the Extended Abstract should be sent to one of the following (according to your location):

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HOTEL INFORMATION - please mention ISDRS when making reservations. To guarantee the rates listed below, you must make your reservation by 11/1/99.

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1999 IEEE Radio and Wireless Conference

Denver, Colorado, USA • August 1-4, 1999

<http://rawcon.org>

Call for Papers

The IEEE Radio and Wireless Conference (RAWCON) is the premier interdisciplinary forum for advances in wireless communications technology. RAWCON highlights the intersections between RF technology and communication system engineering, between system performance and component-level design, between signal processing and RF hardware design, and more. To understand these practical multidisciplinary issues requires interaction among technical specialists with few opportunities to meet. RAWCON offers single track sessions to ensure a broad audience for oral presentations and a stimulating environment for poster presentations. Meanwhile, a comfortable and casual ambiance stimulates in-depth informal interactions. RAWCON's approach has been particularly effective in tracking and shaping the latest developments in emerging areas like Broadband Wireless Access and Local Multipoint Distribution Services (LMDS), which demand multidisciplinary thinking.

RAWCON is a truly international event. RAWCON'98 attracted nearly 150 submissions from 27 countries. The program, including 48 talks, 44 poster presentations, workshops, a panel session, and an exhibition, made front-page news in the electronics industry. Registration was over 300. RAWCON'99 speakers will again appreciate the wide audience, single-track format (including non-overlapping poster sessions), IEEE-distributed Conference Proceedings, significant registration discounts, and broad press coverage.

RAWCON will remain adjacent to Colorado's beautiful Rocky Mountains in 1999. The conference hotel is the full-service Denver Marriott Southeast, with direct freeway connections to Denver International Airport (26 miles) and downtown attractions (10 miles).

RAWCON'99 seeks original, practical technical presentations in:

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- **System and Radio Architecture:** broadband wireless access, 3G mobile, wireless LANs, wireless local loop, PCS, cellular, paging, software radio architectures, etc.
- **Antennas & Propagation:** smart antennas, antenna design, propagation modeling, etc.
- **Active Devices:** linearity, modeling, characterization, technology, RFICs, MMICs, etc.
- **Passive Components:** integrated passives, filters, technology, design, etc.
- **Interdisciplinary Topics** such as smart antennas and system performance; RF propagation and system performance; system design tradeoffs to minimize power consumption; interaction between RF issues and wireless system networking; trends in digital signal processing and their effects on RF system design.

Submission Instructions

Authors are asked to submit five copies of a two-page summary (including figures) to the Technical Program Chair (TPC) by **March 5, 1999**. The summary must contain complete contact information (including email) for the corresponding author. Summaries may be submitted electronically as MS Word, PostScript, or PDF documents. Please indicate your preference for oral or poster format. For further details, see <http://rawcon.org>.

Submissions will be evaluated for originality, significance, technical soundness, and interest to a broad audience. Authors will be notified of acceptance by April 23, 1999. Final accepted papers (4 pages in length) must be received by the TPC in camera-ready form by **June 4, 1999** to be included in the published Proceedings. Direct submissions to the Technical Program Chair.

Exhibition: RAWCON'99 is a great venue to expose your products to world-class technologists in a booth or tabletop display. Please see <http://rawcon.org> or contact the Exhibition Chair for details.

Other opportunities: RAWCON'99 is open to volunteers seeking challenging opportunities. We are also seeking proposals for workshops and panel discussion sessions, and we invite professional groups to consider holding co-located meetings.

RAWCON'99 Co-Sponsors include the IEEE Microwave Theory and Techniques Society (MTT-S), the IEEE Communications Society (pending), the National Institute of Standards and Technology (NIST), and the Institute for Telecommunications Sciences (ITS)



FIRST ANNOUNCEMENT AND CALL FOR PAPERS

Second IEEE-Russia Conference "1999 High Power Microwave Electronics: Measurements, Identification, Applications" (MIA-ME'99)

September 21-23, 1999

Novosibirsk State Technical University, Novosibirsk, Russia

The Second IEEE-Russia Conference MIA-ME'99 is organized by Novosibirsk State Technical University (NSTU), Novosibirsk, Russia; Joint MTT/ED/CPMT/COM Chapter of IEEE, Novosibirsk, Russia; and supported by the IEEE MTT-S, ED-S, CPMT-S, COM-S; A.S. Popov Society for Radioengineering, Electronics and Communications, Russia; Siberia State Research Institute of Metrology, Novosibirsk, Russia.

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Session 1. Characterization of high power microwave systems and devices: Procedures of identification of non-linear devices; Techniques for measurements and testing, Modeling, and Performance Evaluation.

Session 2. Microwave passive and active filters, resonators, component and devices: Analysis/Synthesis, Optimization, CAD and Software Engineering.

Session 3. Microwave electron devices and components: Solid-state devices, Integrated devices, ITS- materials and device, Silicon mechanical sensors.

Session 4. Microwave/RF Mobile, Cellular, Television, Wireless, and Communication Systems.

Session 5. Microwave/RF: Industrial, Scientific and Medical/Biological Applications. Other related topics

Tutorials/Workshops, Exhibitions and Excursions

The Organizing Committee would like to receive proposals for 4-hour Tutorials and Workshops. Exhibitors are encouraged to

present the latest innovations in Microwave/RF technique. Potential exhibitors should submit their requirements to the Vice-Chairman by May 1th, 1999. Excursions will be organized for participants of the conference to Novosibirsk Technopark and Siberia Research Institute of Metrology.

Information for authors

Papers must be received by 30 May 1999. The papers will be refereed and authors will be notified of acceptance by 30 June 1999. Papers presented by students and based on their own work will be considered for the Best Student Paper Award. Limited financial supporting for registration is available to students presenting papers.

Contact and Submission Address:

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More information will be available at:

<http://www.ieee.org/society/eds>

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Paper Submission Deadlines

May 30, 1999: Submission papers to Conference Committee (3 hard copies and diskettes)

June 30, 1999: Acceptance notification

August 10, 1999: Advanced Program

Technically co-sponsored by the IEEE.MTT Society

ANNOUNCEMENT AND CALL FOR PAPERS

Third International Workshop on Transmission Line Matrix (TLM) Modeling Theory and Applications

October 27 to 29, 1999, University of Nice-Sophia Antipolis, France

<http://www.elec.unice.fr/LABO/tlm99.html>

Venue

After Victoria (Canada) and Munich (Germany), the third edition of the TLM International workshop will be held on the campus of the University of Nice-Sophia Antipolis. Situated on the French Riviera between the Maritime Alps in the Mediterranean sea, the country of sun and movie festivals, the Nice region is a very popular tourist destination. An important international airport connects Nice to many important cities in the world.

Objective

The principal objective of this International Workshop is to bring together experts in TLM modeling of wave propagation. Organized every two years, this workshop proposes a review of the state of the art in TLM and in its applications. This year, the objectives will concentrate more particularly on the topics listed below :

TLM cell theory : curvilinear, irregular mesh, body of revolution

New algorithms for ABC

Integration of linear or non linear discrete elements

Frequency domain TLM

New approaches on TLM and coupling with other methods

TLM applications to other areas : optic, mechanic, thermic, acoustic...

Applications of TLM in EMC, antennas, global simulations of complex structures (packaging...)

For the first time a challenging problem is proposed to be solved by any appropriate method. Submitted solutions should include a critical inspection on the efficiency in terms of easy use, precision of the results and computer cost. For TLM solutions, preference will be given to comparison between solutions that involve at least two different schemes or another method. The data of the canonical problem will be available on the web site of the workshop or sent upon request.

Workshop format :

This three day workshop will feature research presentations by invited international experts in selected topics mentioned above, as well as papers

submitted for presentation. All papers will be refereed by the International Steering Committee.

Software demonstrations

Participants will be encouraged to show TLM software, electromagnetic simulators and CAD tools during the workshop.

International steering and program committee :

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Pierre SAGUET	Workshop Vice-Chairman, France
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Christos CHRISTOPOULOS	University of Nottingham, U.K
Dominique POMPEI	Workshop organizer, France

Workshop Digest

A digest containing the written contributions by the invited keynote speakers and the contributed papers will be available at the event.

Submission Guidelines

The contributions should be original. Three copies of a two-page summary (10pt. Times or equivalent on A4 or US letter format) including an abstract (100 words) figures and references. The contribution should indicate the title, author(s), complete mailing address, Fax number and E-mail address (if available).

Important dates

Submission of summary by	May 1st 1999
Notification of authors by	June 30th 1999
Deadline for the final manuscript	September 15th 1999.

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Third International Workshop on Transmission Line Matrix (TLM) Modeling-Theory and Applications
October 27 to 29, 1999, University of Noce-Sophia Antipolis, France

Technically co-sponsored by the IEEE.MTT Society

I plan to attend (delete as appropriate) the workshop (Regular:FF 1200,-Student: FF600)

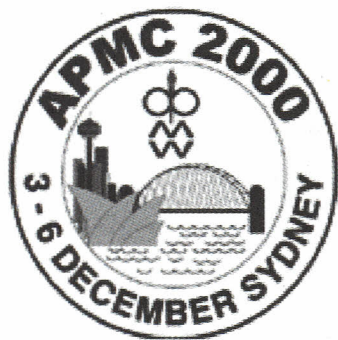
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Please Return to: TLM Workshop c/o Dominique POMPEI, Université de Nice-Sophia Antipolis, CNRS, Bat 4, S.P.I., 250 Rue A. Einstein 06560 Valbonne. France. EMail: pompei@elec.unice.fr. Fax from foreign countries: 33 4 92 94 28 12. Fax from France: 04 92 94 28 12.



APMC 2000 2000 Asia-Pacific Microwave Conference

3 – 6 December 2000, Sydney, Australia
Sydney Convention and Exhibition Centre, Darling Harbour

PRELIMINARY ANNOUNCEMENT

The 2000 Asia-Pacific Microwave Conference (APMC 2000) will be held at the Convention and Exhibition Centre, Darling Harbour, Sydney, Australia, from Sunday to Wednesday, 3 - 6 December. This conference is organized and sponsored by CSIRO Telecommunications and Industrial Physics and is cooperatively sponsored by the IEEE New South Wales, South Australia and North Queensland Sections and the IEEE Microwave Theory and Techniques Society. Sydney is a city of four million people and has a beautiful harbour setting. The Conference venue is close by the harbour and other major tourist attractions.

CONFERENCE TOPICS

Suggested topics are as follows:

1. Computational electromagnetics
2. Computer-aided design
3. Electromagnetic field theory
4. EMC/EMI
5. Ferrite devices
6. Guided waves
7. High-power devices and techniques
8. High-speed digital circuits
9. Industrial applications of microwaves
10. Low-noise devices and techniques
11. Medical/biological applications of microwaves
12. Microstrip and planar antennas
13. Microwave acoustics
14. Microwave/millimetre-wave radar or communication systems
15. Microwave antennas
16. Microwave measurements
17. Microwave-optical interactions
18. MMIC technology
19. Microwave superconductivity
20. Mobile communication systems
21. Optical devices and systems
22. Opto-electronic techniques

23. Phased and active array techniques
24. Remote sensing
25. RF circuits and devices
26. Solid-state devices and circuits

MICROWAVE EXHIBITION

An Exhibition is planned in association with the conference and will be located close to the lecture presentations. Expressions of interest are invited from companies and institutions wishing to exhibit equipment, software or services relevant to microwave engineering.

APMC PRIZES

The Technical Program Committee will award prizes for the best overall paper and student paper.

WORKSHOPS, SHORT COURSES AND SPECIAL SESSIONS

Proposals are invited from persons interested in organizing these events.

TIMETABLE

Initial call for papers:	June 1999
Final call for papers:	September 1999
Paper submission deadline:	1 April 2000
Notification of acceptance:	1 July 2000
Camera-ready manuscript deadline:	1 September 2000

CONTACT

For further information, please contact:

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Ph: +61 2 9372 4289 Fax: +61 2 9372 4446
Email: trevor.bird@tip.csiro.au
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Call for Papers

Abstract and Summary Deadline: 28 May 1999

The wideband, low loss transmission capability of optical fiber links has led to much interest in their use for the distribution and control of microwave and millimeter-wave signals in applications which include antenna remoting, optically controlled phased arrays, microwave signal processing, and wideband cable television distribution. Microwave techniques are also important for future multi-gigabit optical communication systems. Associated with the evolution of these systems is the development of high-speed optical sources, modulators and detectors with bandwidths extending into the mm-wave frequency region.

The International Topical Meeting on Microwave Photonics provides a forum for the presentation of recent advances in this multi-disciplinary research area, ranging from novel devices to systems deployed in the field. The conference is held annually and rotates between North America, Europe and the Asia-Pacific Region. The 1999 meeting will be held in Melbourne, Australia. Authors are invited to submit original papers to MWP'99 on the following topics:

DEVICES, COMPONENTS AND TECHNIQUES

- microwave and millimeter-wave signal generation
- optical sources (laser diodes to mode-locked lasers) and detectors
- light modulation and detection
- optical fiber links
- optically controlled devices
- signal processing functions
- ultra-fast probing and measurements
- high-speed analog to digital conversion
- device and circuit design and modeling
- hybrid and chip level integration of devices and circuits

APPLICATIONS AND SYSTEMS

- fiber-fed wireless systems
- optical wireless systems
- control of array antennas
- satellite-based applications
- distribution of CATV (and sub-carrier multiplexed systems)
- hybrid fiber coax access
- Terahertz techniques and applications
- microwave aspects of analog and digital fiber-optic communication systems
- WDM techniques and applications

The conference will be highlighted by a number of invited talks and will include a Tutorial on Mobile Communications and a Technical Exhibit. More information on MWP'99 including detailed instructions for paper submission can be found at the conference web site.

or contact:

Dalma Novak
Dept. Elec. & Elect. Eng.
The University of Melbourne
Parkville VIC 3052
Australia
Email: d.novak@ee.mu.oz.au



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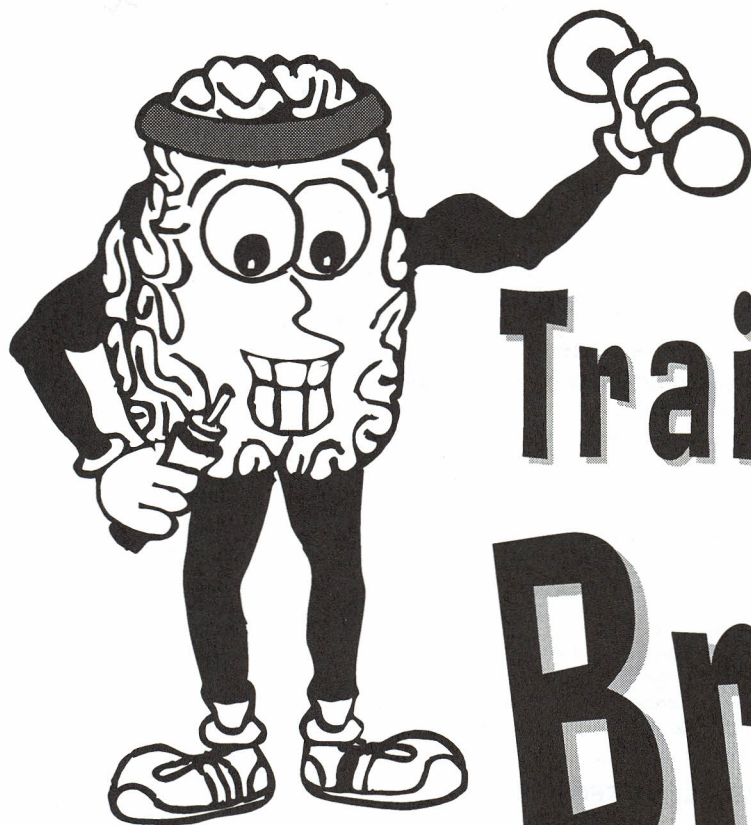
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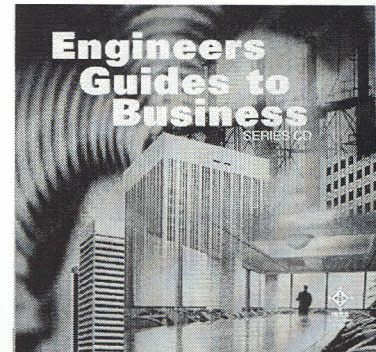
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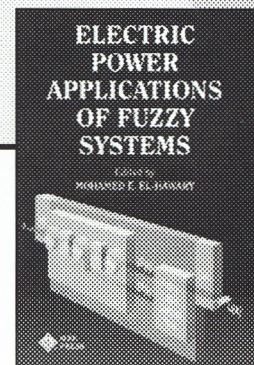
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