

IEEE MTT-S International Microwave Symposium June 11-14, 1991: Boston



by Peter Staecker
Chairman, 1991 IEEE MTT-S
IMS Steering Committee

MIT Radiation Laboratory: 50 Years

The theme of the 1991 Symposium is a celebration of the MIT Radiation Laboratory, formed 50 years ago in October 1940. RadLab brought together hundreds of outstanding scientists who fashioned the British invented magnetron into a key component of radar technology and in so doing laid the groundwork for the birth of microwave theory and techniques as we know it today. A number of RadLab alumni will be with us during the Symposium; our committee has already contacted over 300 people and over half have indicated that they plan to attend. There will be a special session where significant events of RadLab history will be recounted and special social events will be included in the program to commemorate the achievements of our special guests.

A commemorative calendar was sent to MTT membership in October. In addition to giving you some of the historical and personal insights into the founding of RadLab, the calendar will also serve as your personal planner of special events leading up to the Symposium. Incidentally, the birth of the Radiation Lab was celebrated officially in early October this year with the presentation of a plaque to MIT from the IEEE Center for the History of Electrical Engineering, designating the "development of microwave radar by the MIT Radiation Laboratory - 1940-1945" as an IEEE Electrical Engineering Milestone.

Preparing for the Symposium: TPC Meeting

The first event of major consequence in preparing for the June meeting is, of course, the Technical Program Committee (TPC) meeting which will be held on January 13, 1991, at the Westin Hotel (Copley Place) in Boston. For those attending this meeting, please read the note on travelling in Boston, below. For those of you intending to submit papers you may have noticed some strong language in the Call for Papers regarding timely submission. Masse and Thoren are not kidding. No late papers will be accepted.



The Radlab developed radars for land, sea, and air applications. None was more well known than the SCR-584, which is shown here. It was used in all theaters of WWII and was largely responsible for the high kill rate against the German "Buzz Bombs," which were sent to attack England. A superb tracking radar, it is still in use on some test ranges even today. (Photo courtesy of the MIT Museum.)

The Symposium Program: Thousands Sent, Hundreds Received

The Advance Program is a perennial problem. It costs too much, very few people seem to receive it, and it arrives too late. To cut costs, previous Committees have made truncated versions of the program to send first class to overseas members.

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MTT-S Newsletter Staff

Editor: Gary Lerude
Phone: (214) 995-5678
Fax: (214) 995-4288

Mailing Address
Texas Instruments
P.O. Box 655474, MS 402
Dallas, TX 75265

Overnight Delivery
Texas Instruments
13510 N. Central Expressway, MS 402
Dallas, TX 75243

Feature Articles Editor: John Eisenberg
Phone: (415) 941-7426

Mailing Address
25 Parsons Way
Los Altos, CA 94022

Region 8 Editor: Rolf Jansen
(Europe, Middle East, Africa)
Phone: 49-2102-83095
Fax: 49-2102-842391

Mailing Address
Industrial Microwave and RF Techniques, Inc.
Neanderstrasse 5
D-4030 Ratingen, West Germany

Copy and Layout Editor: ShariGRAPHICS
(800) 735-5498

2550 Forest Grove Estates Road
Allen, TX 75002

President's Message



by Tatsuo Itoh

Many of you have noticed that the winter 1990 issue of the Newsletter and the 1990 IEEE MTT-S Committee Directory has been delayed substantially. Gary Lerude, Newsletter Editor, has resigned and has decided not to seek reelection to AdCom after his current term expires at the end of 1990. This incidence has given me grave disappointment at a time when the service to membership has become increasingly important and transnational activities are expanding.

Harlan Howe had to resign from the Chairmanship of the Nomination Committee due to his job assignment. John Horton has accepted this position with a very tight schedule. He did an excellent job at the recent AdCom meeting where the AdCom election was held.

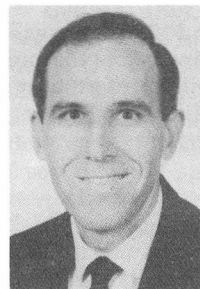
In spite of the dedication of many individuals, MTT operations are strictly voluntary in nature. In recent years, many job related commitments have made this voluntary service increasingly difficult.

Work on the first issue of the new IEEE Microwave and Guided Wave Letters to be published in January is in full swing. The inaugural issue will be published on schedule. All MTT members will receive this journal free of charge in 1991. After 1992, this journal will become the core publication of the society and the MTT Transactions will become an extra cost item.

In the area of transnational activities, several new overseas chapters have been formed. Some assistance is needed in forming new chapters, particularly in Eastern Europe. However, many issues require clearer IEEE positions. The Asia Pacific Microwave Conference was very successfully held in Tokyo in September. Many Pacific and Asian countries expressed enthusiastic interest in holding future meetings. The next APMC will be held in Adelaide, Australia, in August 1992. MTT is looking forward to the future growth of the APMC.

Martin Schneider was elected Division IV Director for 1991 and 1992. This is an IEEE BoD position. Although Martin's announcement for candidacy was distributed late due to the delayed Newsletter, he still won by a landslide. Obviously Martin has significant name recognition within the four Societies' Membership which makes up our Division IV.

Editor's Comments

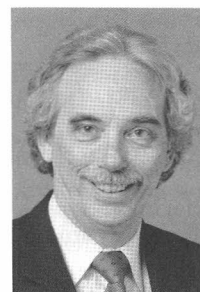


by Gary Lerude

As discussed in the Editor's column in the last issue of the MTT-S Newsletter, due to work commitments this year I have found it difficult to devote sufficient time to publishing the MTT-S Newsletter and maintaining the normal publication schedule. Recognizing that one of the key responsibilities of an editor is to provide a timely source of information, I have, with much regret, resigned as Newsletter editor. My work responsibilities will continue to demand periods of total focus, which would unfortunately impact the Newsletter schedule.

Effective with the next issue, John Wassel assumes the role of editor (see article Membership Services on page 45). Coming to my rescue to publish this issue is Al Estes, who agreed to serve as guest editor and publish this issue in record time. I really appreciate Al's support during this transition period. His personal dedication to serving you, the MTT-S membership, deserves our many thanks.

Guest Editor's Comments



by Al Estes

Whew!! We finally got it out. And do I mean "We." The Winter/Fall Newsletter is in the mail as I write this to you. It seemed as though we had all of IEEE at Piscataway, New Jersey, assisting us in mailing the Newsletter. Our thanks to all of them. The 1990 Committee Directory for the IEEE MTT Society is stapled inside. I hope you save it since there are addresses and phone numbers within the directory that could help you when you desire to make suggestions or comments to our Society's leaders. The new editor, John Wassel, promises to put the Newsletter back on schedule. Therefore, the 1991 Committee Directory will be in your hands in April with the Winter/Spring 1991 Newsletter. I hope you can make use of the 1990 Directory until then.

At the last AdCom meeting in San Diego, AdCom was emphatic that the Newsletter be brought back on schedule. They wanted another Newsletter out this year. We had enough useful newsletter material plus time to get one more Newsletter issue out by the end of the year. I volunteered to assist Gary

(cont. on next page)

The cost savings is substantial: greater than \$10,000. We will probably follow this path, but will start mailing before the end of January, to ensure timely delivery of the critical information and forms. We are also looking at the possibility of publishing program conference registration forms well before the Symposium in one or more trade magazines.

Symposium Review

Starting sometime in 1991, the City of Boston will initiate the Central Artery Project. This major expressway renovation program will present a significant additional challenge to those wishing to drive through the city. Taxicabs and limousines are a less stressful alternative, and the MBTA is cheap (\$.75), quick (about half an hour from Logan to Copley Place) and safe. Since our symposium site is in the center of the city, we recommend that you do not drive.

The Symposium will take place in the new Hynes Convention Center which has been open for about 2 years and is located in Copley Place. The 3 major hotels will be the Sheraton, which you may remember from 1983, as well as the Marriott and the Westin, our co-headquarters hotels also located in Copley Place. It appears at this time that we will fill the 520 booth capacity of the second floor of the Hynes. The historical exhibit this year will have a special significance because of the focus on the MIT RadLab.

Highlights of Symposium Week are as follows:

- Monday, June 10, 1991: MTT Workshops; MMWMC Symposium; Microwave Journal Reception.
- Tuesday, June 11, 1991: Guest Tour Activities; MTT Plenary Session; Joint MTT-MMWMC Technical Session; Opening of Microwave Exhibition; MIT RadLab Special Technical Session; MTT Nite at Pops.
- Wednesday, June 12, 1991: Guest Tour Activities; MTT Technical Sessions; Open Forum; Microwave Exhibition, Industry Cocktail Reception; MTT Awards Banquet.
- Thursday, June 13, 1991: Guest Tour Activities; MTT Technical Sessions; Microwave Exhibition, ARFTG Technical Sessions; ARFTG Banquet.
- Friday, June 14, 1991: MTT Workshops; ARFTG Technical Sessions.

Planned also for Microwave Week are special invited speakers from Europe and a student paper session featuring student finalists in the student paper contest.

We have already received 16 applications for workshops and 5 for panel sessions. The Open Forum organizers are planning innovations to their activity to add to that part of the technical program. A special student paper contest is being planned, and booths in the exhibition area will be set aside for University use.

A note on the symposium fee structure

While the IEEE MTT-S International Microwave Symposium is recognized as *the* technical focal point of the microwave community each year, its registration fee structure is disproportionately low. Over the next 2 to 3 years, the fee structure will be examined closely and modified to bring it to parity with other similar meetings. This year you will note a substantial difference between member and non-member fees. In addition, early registrants will have a substantially lower registration fee than those registering on-site. With these changes, we will be able to better service IEEE membership, while decreasing the load on the on-site registration personnel.

Lerude by expediting the typeset, formatting, printing, and mailing of the Fall 1990 Newsletter. I promised to mail this Newsletter by November 23 to AdCom and to Gary so it would reach most Members by mid-December. At this writing, I have checked the typeset and preliminary formatting. I join Gary in that my hat is off to Peter Staecker for his splendid work as Newsletter editor FOR THREE YEARS!! With all this hands-on experience, I now believe editing and putting out an MTT Society Newsletter is like designing, developing, and finally shipping a parametric amplifier; you only want to do it once. But Peter did it nine times.

I wish I could convey to you the vast amount of energy it takes to complete a Newsletter from the get-go. If our Members knew this then they might understand why myself, and I am certain, other AdCom Members share disappointment about not hearing from our Membership about not receiving any Newsletters this year.

You read it correctly. Of our over 10,000 Members, not one AdCom Member was approached by an everyday MTT Society Member about not receiving any Newsletters!! Sure Kiyo Tomiyasu (Past President and Past Division IV Director) called our President, Tatsuo Itoh, and complained in April 1990. Both Tatsuo Itoh and Ferdo Ivanek started calling Gary and me in April, BUT, not one everyday Society Member (who was not active in the Society leadership) has bothered to complain about not receiving the Newsletter to this very day! This makes me wonder about the value the Newsletter has to the Membership from the Membership's perspective.

All Chapter Chairmen I talk with tell me they think distributing a Newsletter is important. Some Technical Committee Chairmen have indicated distributing the Newsletter in its present format is important. I am in daily or weekly contact with almost one hundred microwave engineers, most of whom belong to our Society. Not one, to this very day has asked me about the Newsletter being late or missing. Some engineers have voluntarily told me that they will not continue with IEEE or MTT-S and always give a reason. But they never mention the Newsletter.

Here is why I am disappointed in this lack of response from our Membership. Our Society spends \$65,000 to provide three Newsletters a year to our Membership. No one except a couple hundred Members who are active in leading our Society seem to care one way or the other. I should mention some AdCom Members think we should discontinue the Newsletter. The main point here is at least they are vocal about their opinions.

It appears to me that perhaps \$65,000 is being wasted. Our Society could reduce each Member's annual MTT Society dues from \$12 to \$6 if we discontinued the Newsletter. Or our Society could increase services in other areas: MTT-S could quadruple the Distinguished Lecturer's Program; or either increase the Speakers' Bureau service, or the Chapter meeting support activity by a multiple of SEVEN! What do you think? What is your opinion?

I am starting an Ombudsman Program to receive, hear, and service Members' complaints. I also serve on an Ad Hoc committee formed by Tatsuo Itoh to review Newsletter format changes and report to AdCom in January 1991. The committee is chaired by our Vice-President-elect Reynold Kagiwada. Martin Schneider is chairing another Ad Hoc committee that is working on recommending changing, or not changing the Newsletter to a magazine. Write, call, or fax Reynold, Martin, or myself about what you think. Or write a letter to the editor and send it to John Wassel. I encourage you to be active on this subject or any subject you have concerns about. We want to hear from you.

(cont. on page 57)

All the World Is a Filter

by Dr. Richard V. Snyder
President, RS Microwave

Abstract

This paper will highlight the impact of three technological developments on filter design: desktop computers, active implementations of previously passive circuits and superconductivity. The first of these will be shown to offer improvement in productivity. It also places multi-disciplinary demands on the programmer. The latter two will be shown to enable incorporation of high-Q components into networks built with potentially low-labor content methods such as MMIC.

Saith the Bard—or was it Seymour? I know that our title is my answer to those who ask “what in the world is a filter”?

Introduction

“Filter: a device or material for suppressing or minimizing waves or oscillations of certain frequencies”. . . per Webster. This definition, while accurate, is insufficient for microwave engineers. Microwave systems and components enhance and direct, as well as suppress, waves and oscillations. Does an amplifier minimize or maximize? Does a switch direct a maximum of energy through an “on” port? Components such as circulators, mixers, amplifiers, oscillators, switches, (in common with complex systems) are, in fact, filters in which inherent physical properties are represented as smaller, constituent networks, which are then embedded within actual or virtual filter networks, that in turn define the overall response of the device or system. To define “embedding”¹⁷: the terminals of well-defined subnetworks are provided with a known interface to the rest of the system, thus providing selective suppression or enhancement of some oscillatory effect within the device or system.

The concept of “embedding” subnetworks, as defined above, applies not only to microwave devices, but to such complex systems as bridges, electric power grids, water systems and probably ecosystems, as well as to the design of modern “filter” networks more familiar to the microwave field.

Modern Methods of Design and Realization

At least three fundamental changes have had, are having, or very well could have a significant impact on filter design and realization. These changes are the desktop computer, active implementations of passive designs, and superconductivity. In addition to these, a host of smaller developments in efficient network design, such as cross coupling, dielectric materials, processing capability, machining precision and speed, “drop-in” and surface mount packaging, have emboldened the filter designer to seek better performance, smaller size and reduced cost in manufacturing. This paper will not attempt to cover all of these areas, but will concentrate on those which have experienced the greatest changes in the last few years. With the availability of significant desktop computer power, filter design today has come to depend less upon classical synthesis

and more upon the ability to define the responses of subnetworks which are specially characterized for the particular situation. These linear or non-linear subnetworks are carefully defined, or characterized, so that the computer can simulate and optimize their interaction, thereby determining a point at which the desired overall response is achieved. Frequently, (but by no means exclusively) the characterization uses a very pragmatic approach: a vector analyzer measures data and develops the matrix elements applicable to the power level, frequency and spatial location of the subnetwork. In other cases, field theoretic descriptions of particular elements and field theoretic methods such as finite elements, spectral domain, time domain and others are used to provide the terminal characteristics of the embedded subelements. The result of this approach has been to make possible the design of networks which contain both lumped and distributed elements. Synthesis of networks containing both types of variable is usually difficult or impossible because these variables display entirely different forms of frequency response. Networks which cannot be totally synthesized can be accurately “designed” (some say computer-diddled). The reduction of lab time resulting from accurate design simulations is probably the major reason that the cost of microwave components has been kept disproportionately lower than inflation . . . without bankrupting too many microwave companies. In conjunction with the impact of the PC, we must consider the effects of new technological and scientific developments. One of my mentors once told me that two things would never be successfully integrated: low noise and high power. Although still true in the limit, these quantities have been and will continue to be impacted by the advent of the two other major developments: active filters and superconductivity. The effects of these two exciting technologies will be discussed in conjunction with other aspects of modern filter requirements.

Modern Filter Requirements

Filters

Filter designs (and designers) are inherently customer driven. However, the “drivers” are also driven by available technology. Over the years, customers have always wanted the same things: smaller size, better performance and lower price. In conjunction with these market-based considerations, the physics of filters must be considered. With the exceptions of high power or narrow band requirements, better performance frequently requires small size. The performance of broad band components is compromised when parasitic delay elements are contributed by large resonant element separations. However, small size has been difficult to achieve on a “cost-effective” basis, with yield and rework contributing excessive cost. As technology has developed, it has become possible to build networks small enough so that performance limits are imposed by the unwanted or unexpected interaction of internal elements. The newer production technologies produce lower cost components, as well as smaller ones. Another limit on passive networks is imposed by the relatively low Q and current carrying values which can be achieved by small components.

Let us now examine the design techniques available in the early 1960's. Figure 1¹ is a summary of the various passive filter techniques versus frequency range, recommended for use in that early era. Figure 2 and 3² show the available unloaded Q and optimum size for the resonator types of Figure 1. Figure 4 shows modifications to bring us to the present state of the art. Although some progress has been made, particularly in the use of low loss dielectric and multi-mode waveguide resonators, the fundamental passive element volume-Q limits are still with us. Another limit in the choice of resonator type

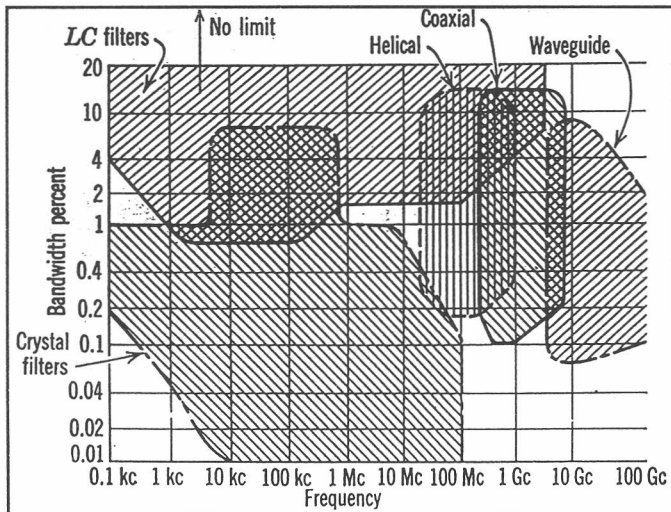


Figure 1.
Filter Selection Guide (1960's)

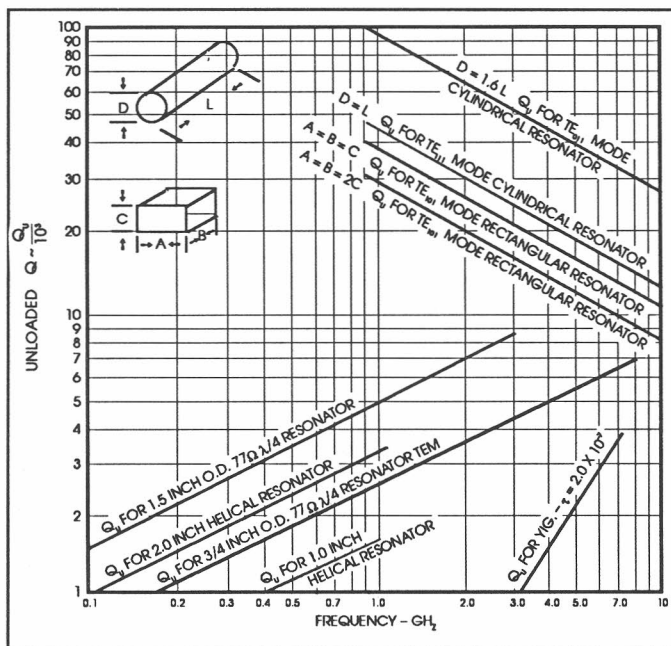


Figure 2.
 Q_u for Various Resonators.

(The helical resonator is equivalent to a quarter-wave coaxial transmission line resonator.)

is set by requirements on spurious-mode bandwidth. A given network is usually required to provide a stopband with minimum frequency limits. If the resonator eigenmode spectrum allows additional resonances within this stopband area, very clever design indeed is required to avoid the detrimental effects of these spurious modes. Dielectric and waveguide resonators are particularly sensitive in this area, but TEM or quasi-TEM networks also must be carefully designed to avoid unwanted mode propagation that would limit stopband and passband integrity. In some cases, these unwanted resonances are suppressed by cascading other filters with different spurious resonant properties. Thus, one filter acts to eliminate the out of band resonances of the other. The problem with this approach is the deleterious effects of the second filter on the passband of the first. This additional loss and group delay is due both to the redundant coupling elements associated with getting in and out of each filter, and to the VSWR of each. To alleviate this problem, it is possible to combine elements with

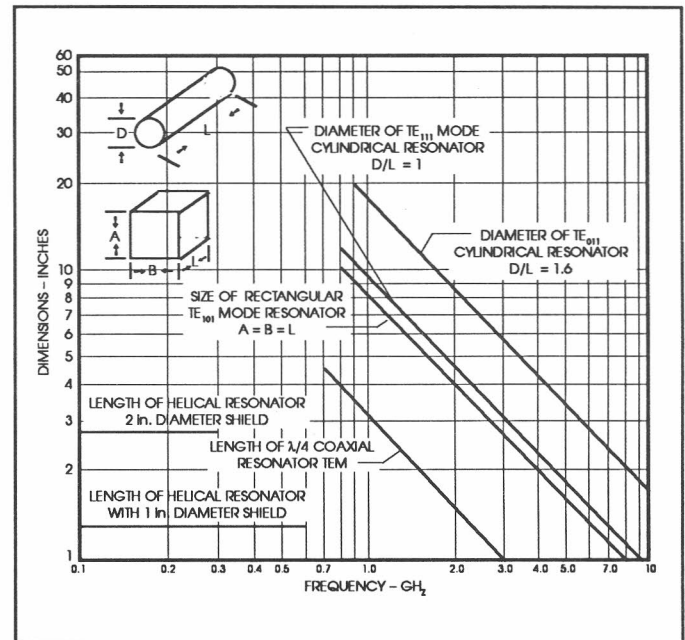


Figure 3.
Size of Various Resonators as a
Function of Frequency.

(A YIG filter [not shown], operating between 2 to 10 GHz, would have a garnet diameter of approximately 0.075 in. This dimension does not reflect the size of the required magnetic field source.)

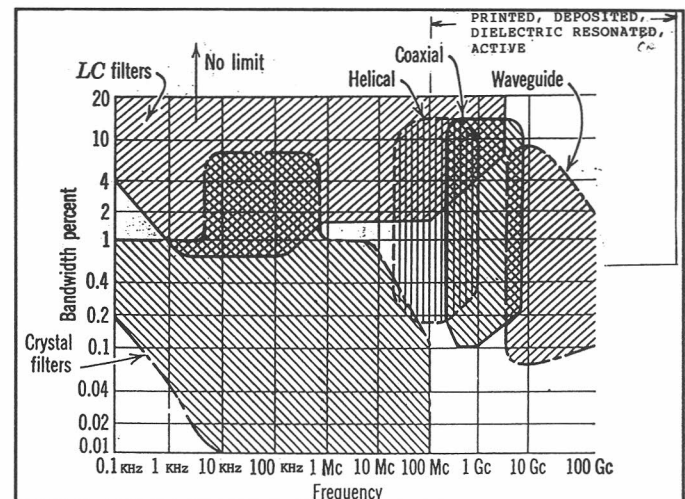


Figure 4.
Filter Selection Guide (1990's)

Newer Techniques:

Waveguide: Bandwidth fractional % to full waveguide band
Printed or deposited: 100 MHz-100 GHz
Bandwidth 1% to 100%

Dielectric Resonators: 1 GHz to 30 GHz
Bandwidth 0.3% to 1%

Active Filters: Low KHz to 10 GHz
Bandwidth: Fractional % to octave

different spurious properties within the same filter. However, a design requires characterization of both the individual elements and the coupling network joining them together.

Consider the high power waveguide cavity filter shown in Figure 5A. If all cavities employ the low loss cylindrical TE₀₁₁ mode, the passband and stopband characteristics are as shown in Figure 5B. If the middle cavity uses a lower order mode, such as the TE₂₁₁, the passband and stopband are as shown in Figure 5C. Figure 5D is a photograph of a filter in which the end cavities use the TE₁₀₁ mode while the center cavity uses

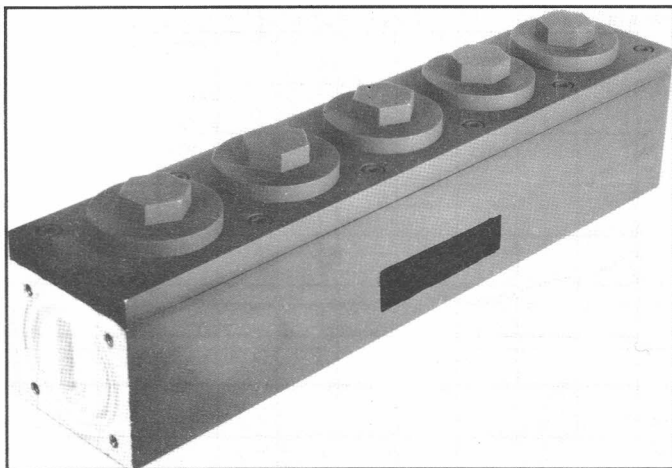


Figure 5(a).
High Power TE011 Cavity Filter.

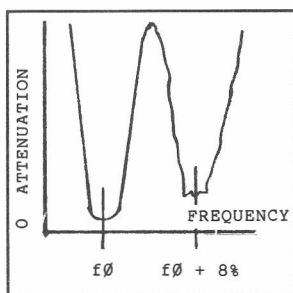


Figure 5(b).
Main and Spurious
Response of TE011
Cavity Filter.

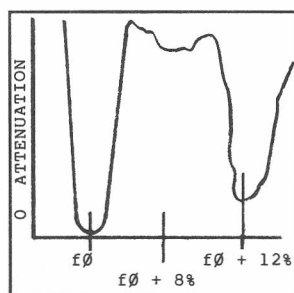


Figure 5(c).
Main and Spurious
Response
TE011 Filter with some
TE211 Cavities.

the TE111 mode. The approach increases the spurious-free stopband width at the cost of a small increase in passband loss. However, the situation here is representative of the general problem: how to express the coupling between the two modes of operation in a form suitable for computer-aided design? Of course, for narrow band situations or for very low order structures such as the waveguide cavity filter considered, the traditional approach³ has been to measure the coupling coefficient between two isolated resonators operating in the desired modes, coupled with an iris or coupling structure similar to that anticipated in the final filter, and then to adjust the iris size until the coupling coefficient is the value required in the final filter. Both the basis for computation (lumped element equivalent networks) and the measurement of the coefficient are suitable only for the narrow band circumstance described. Since minimum size, loss and group delay are common requirements today, it is necessary to combine lumped elements, below-cutoff waveguide, propagating waveguide, coaxial and stripline elements, diodes, transistors, etc., taking from each the most desirable properties while eliminating the worst. An example of a filter combining lumped and stripline elements is shown in the schematic of Figure 6. This filter comprises a lumped bandpass, a mixed lumped and distributed bandstop, a lumped matching transformer and a Tee-pad. The bandpass consists of a direct-coupled circuit, with some series elements capacitive and some inductive. Including both capacitive and inductive series elements enhances the stopband slope of the bandpass filter. The bandstop section utilizes capacitively-coupled shunt resonators. These resonators consist of high-impedance stripline sections in series with short lengths of lumped inductance. The inductors act to reduce the required length of the striplines without losing much of the high un-

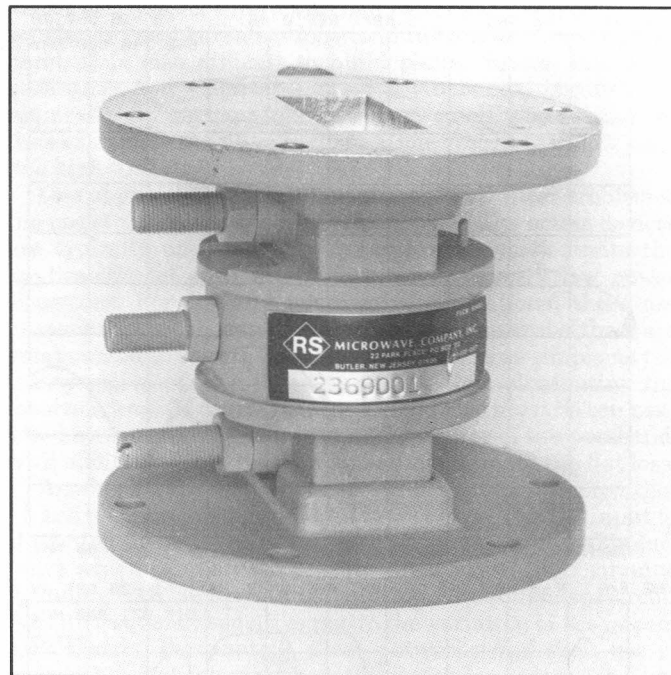


Figure 5(d).
Multimode Cavity Filter.

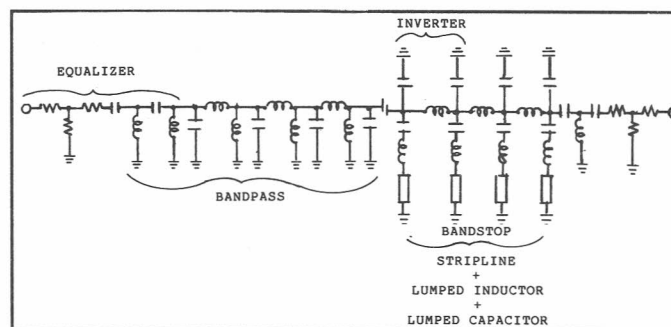


Figure 6.
Mixed Lumped-Distributed
Equalized Bandstop.

loaded Q property of the distributed striplines. The required inverting lengths between resonators are provided by Pi-equivalents to quarter wave lines, with the Pi elements "embedded" into the series and shunt portions of the bandstop elements. The pad and matching transformer act as a group delay and amplitude equalizer. The direct synthesis of such a filter would be quite difficult, if not impossible, due to the cascade of the lumped inductance and distributed line within each shunt resonator. The synthesis would contain variables with two different forms of frequency dependence. However, it is easily possible to describe the form of variation and analyze the composite response. Knowing what general form of response is required, it is not difficult for the designer to set up the network topology, manually optimize ("eyeball it") until close, then let the machine do the "twiddling". A simulation program and optimization are used to achieve the customer-required passband flat amplitude and delay characteristics, in conjunction with a deep notch right next to the passband. The overall response of this filter is shown in Figures 7A and 7B.

Filter Subsystems

Over the years, some of the most arcane microwave filter networks have been those that perform multiplexing.^{4,5,6,7,8} One of the technological developments that has recently af-

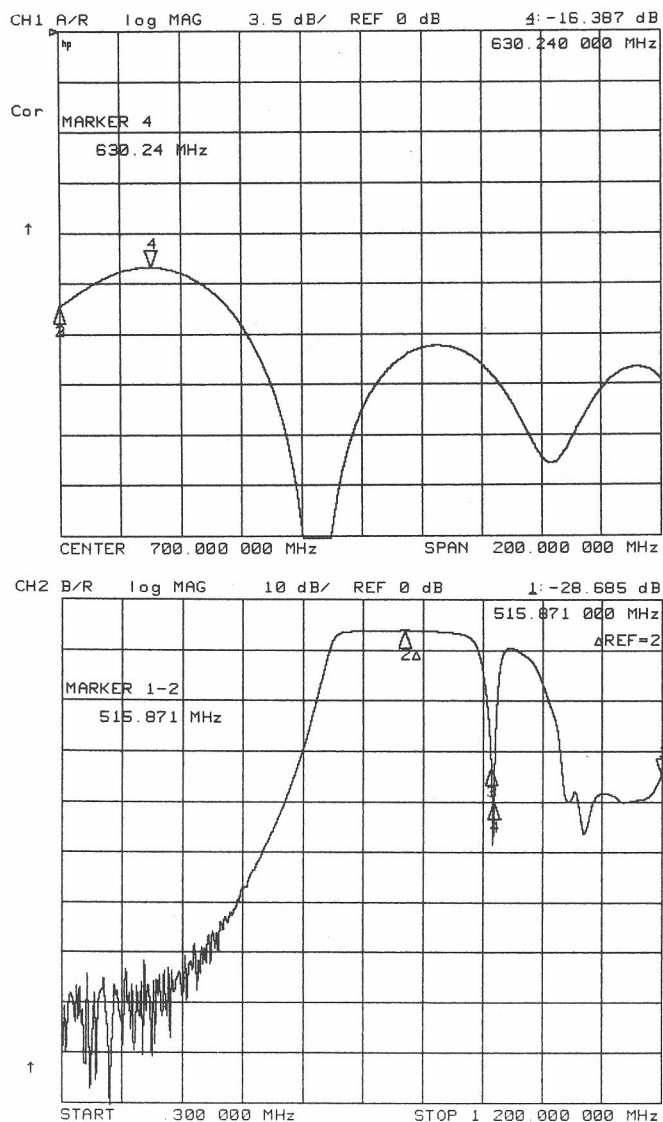


Figure 7(a).

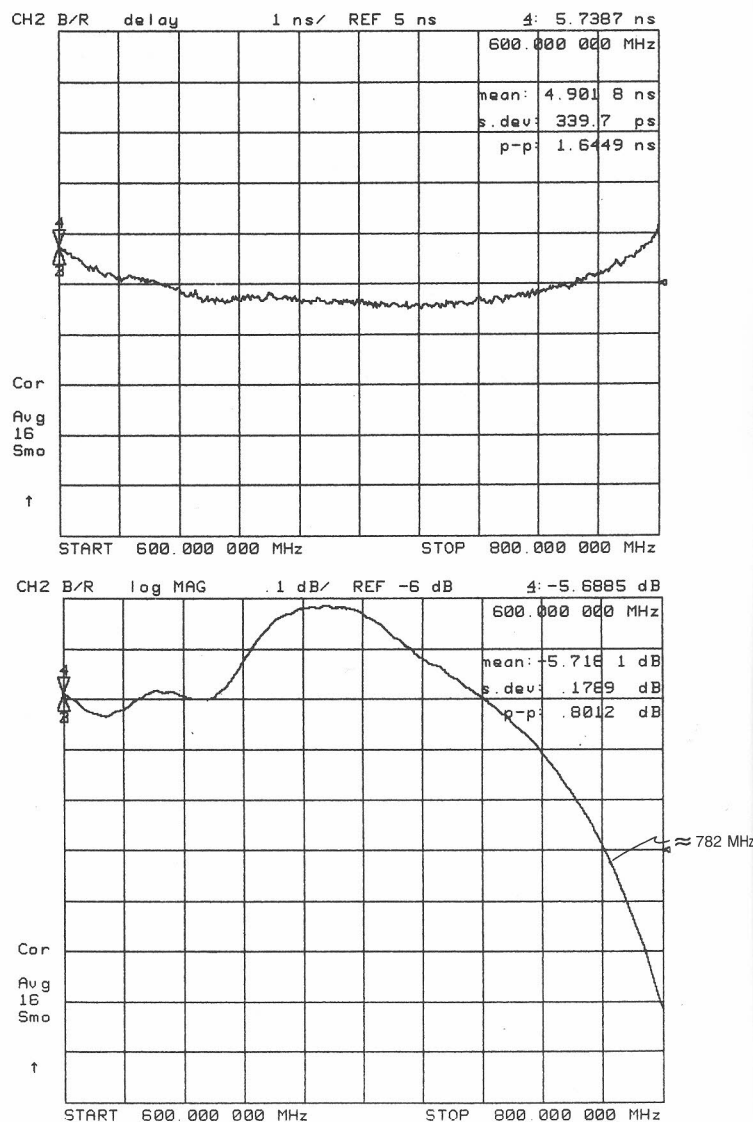


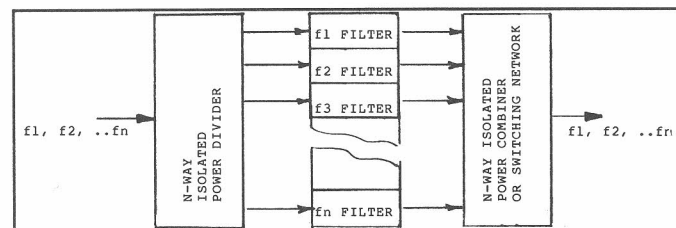
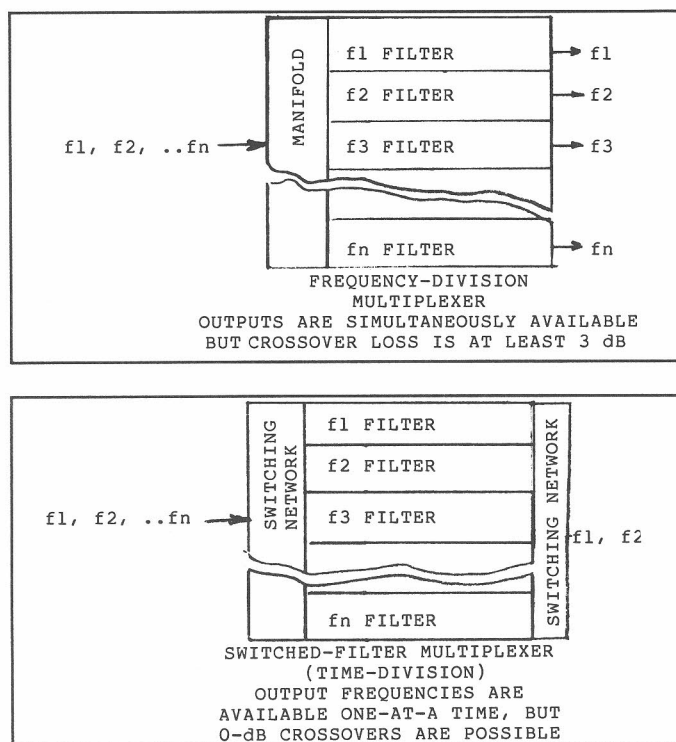
Figure 7(b).

fectured system architecture as far as the use of such networks is concerned, is the availability of compact pin diode and MMIC switches. These small devices make possible the minimization of junction effects necessary for broad band operation. Figure 8 illustrates the application of both real time (frequency division) multiplexers and switched filter assemblies (which perform time and frequency division functions). The switching time of the switches involved is so short that processing output data from a switched channel takes much longer than the time to switch between channels.

Therefore, the "time-shared" nature of the available output data may not cause any degradation in system response time, except in a very few cases where sensitivity is not a primary issue. Thus, an assembly consisting of filters and switches displays some advantages over the purely frequency division device. These include:

1. Full band coverage without crossover notches (so-called "0" dB crossovers) are possible. A purely frequency division device must have crossover points at least 3 dB down.
2. As the degree of multiplexing increases, the switched device can be built more easily than the solely frequency division device. High order (greater than fourth or fifth) multiplexers are less a computer optimized design and more a fabrication art form. The switches select single filters, in a straight forward fashion, one at a time.

A disadvantage of the switched multiplexer is the somewhat higher insertion loss of the switches as compared to the frequency-division multiplexer manifold. A SP8T switch covering the 6-18 GHz range will display about 3.3 dB loss per channel, for isolations of 30 dB. Thus, a pair of these can be used with 8 bandpass filters to split the 6-18 GHz band with about 7.5 dB loss per channel, and 60 dB interchannel isolation. If the equivalent device were built without switches, the loss would be about 3 dB per channel, except in the crossover region. In this latter region, loss would go to about 6 dB maximum. Isolation would also be about 60 dB 10% to 15% away from any crossover frequency. The small loss difference advantage to the device without switches is offset in most cases by the smaller size and reduced labor content, which results in lower cost for the switched device. Another multiplexer form which allows crossovers at less than 3 dB is a device known as a frequency thinner.⁴ An example of such a unit is shown in Figure 9. Here, an isolated power divider is used to combine various filter elements. The flat loss of the power divider substitutes for the crossover uncertainty area, so that conservation of energy is not violated. However, the flat loss of the power divider is the absolute minimum insertion loss for any channel. In an era where gain is cheap, variations on this theme have become quite common. In some cases, all three approaches are employed within the same "black box". A frequency thinner might

**Characteristics:**

- (1) 0-dB crossover possible. Power divider loss makes this possible.
- (2) More than one output is available simultaneously.
- (3) If switches are included, one or more outputs can be selected or de-selected simultaneously, without impact on input/output VSWR.

encompass frequency division manifolds, power dividers, bandpass filters, amplifiers and switches... with the switches actually formed by diodes embedded into portions of the selective filters.

Active Filters

In this cost-sensitive, high labor cost era, we must ask ourselves which of the above elements can be fabricated using automatic, low-labor methods such as MMIC or similar technology. The natural division for passive components is one dictated by the required unloaded-Q of the circuit. Thus, broad band components such as switches, amplifiers, power dividers are intrinsically capable of two dimensional or at least very thin fabricated format, with performance comparable to connectorized construction. Filters, circulators and stabilizing resonators do not lend themselves to such methods, if restricted to purely passive, non-superconductive implementations. Planar, or "semi-planar" circuits (those using air bridges or crossovers) are limited in unloaded Q to values not much greater than 200 or 300. The losses exhibited by filters are generally inversely proportional to both bandwidth and un-

loaded Q. Thus, for filters with bandwidths of less than 10% or so, planar passive realizations tend to be lossy. On the other hand, it is also difficult to build planar filters with wide passbands and simultaneous wide stopbands, because the required coupling gaps tend to be very small. The devices are thus extremely sensitive to fabrication, resulting in low yield and high unit cost.

One approach to the solution of the planar filter problem is the use of various active networks.^{9,10,11,12,13} The active devices are typically used in their linear range, which limits the applicability of such filters to receiver or very low power situations. For RF and microwave applications, there are numerous approaches which are available. Several of these are summarized in Figure 10. Some designs are as simple as the incorporation of gain into the circuit, thus eliminating the insertion loss. Of course, the gain slope also must be compensated by the addition of loss near the center of the passband, with additional positive gain added to eliminate the flat loss.

Another approach shown employs impedance rotation within an active device, to simulate an inductance. The DC input to the active device is translated into an apparent high Q inductance which can be used to form a variety of filter circuits, including both bandpass and bandstop. The equivalent circuit is quite frequency sensitive due to the variation of the impedance matrix. Fortunately, these networks find their use in narrow-band situations, where this dependency does not cause problems. This deficiency can be exploited, however, as such filters can be readily tuned over a wide range of center frequencies. Tuning may be accomplished using varactor diodes or directly varying FET capacitance. Another problem with this technique is stability versus temperature. As with circuits intended to be oscillators, a variety of methods are used to stabilize designs of this type.

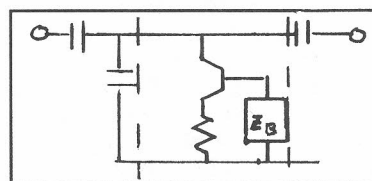


Figure 10(a).
Single-Resonator Impedance Rotation.⁹

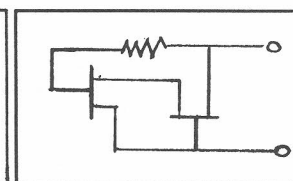


Figure 10(b).
Active-Inductor.^{10,11}

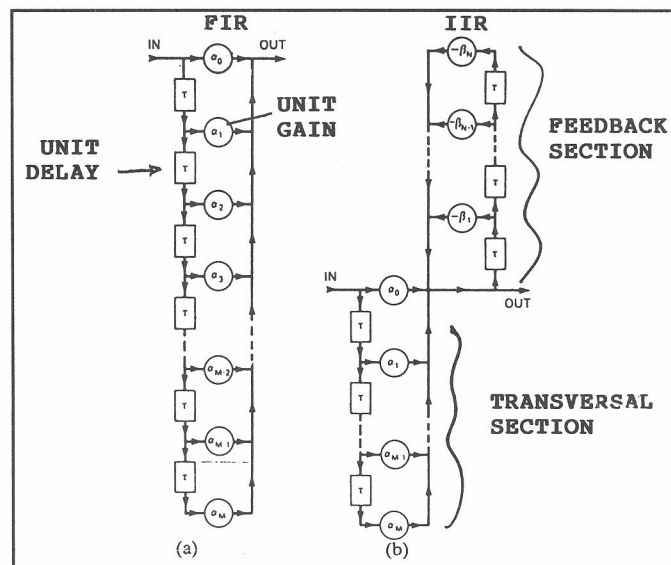


Figure 10(c).
Flow Graph Examples of Distributed Filters:
(a) Transversal Filter; (b) Recursive Filter.

More recently, FET's have been combined with phase length balun circuits to form microwave transversal FIR and IIR filters.¹³ Using feedforward and feedback in conjunction with prescribed phase shifts and gain blocks, this approach makes available to RF designers the unit-delay or Z-transform based approach to filter synthesis. If appropriate compact balun circuits are employed in place of the line lengths, bandpass networks of this type could achieve up to octave bandwidths in fully planar, compact configurations. Clearly, the use of active components within filters and other resonant networks can compensate in a myriad of ways for the low Q of inductors and capacitors fabricated with planar technology. With circuits of increasingly complex nature, it is important to have available very accurate characterizations for the active components, as well as the passive, so that the simulation power of the desktop computer can be efficiently employed.

Superconductive Filters

Easily the most exciting potential innovation in the design of filters is the use of high temperature superconductors in fabrication. Suddenly, the old rules on volume versus Q are out the window. Or are they? As we examine both popular and scientific literature, we can see the possibilities of using materials ranging from YBaCuO based ceramics operating at 77 to 125 K, to stable, room-temperature superconductive metallic hydrogen formed under 2,000,000 atmospheres of pressure.^{14,15,16,17} As we read about the potential, we also learn of the problems. Can wire be made from these new materials? If so, superconductive wire or thin-film inductors could be used in lumped element networks, eliminating the low-Q deficiency. Can the superconductors carry high RF currents without losing the "super" properties? If so, these materials could revolutionize the design of high power filters, making possible the use of smaller cavities without the closely spaced eigenmode spectrum problem. Can reliable contact to the center conductors formed from superconductive materials in printed implementations be made? If so, one can print all the planar structures wanted without the Q limitation. Is operation practical without complex cryogenics? Will the materials exhibit long-term stability without isolation from the real world environment? Recent results with planar circuits using 77K material, operating at about 66K have shown excellent results, with potential applications to satellite-born filters.¹⁶

Other natural areas for such slightly cryogenic devices are for clock filters in the cryostats of supercomputers operating at low microwave frequencies and in deep space where low temperatures are readily available. Results with these new materials must always be compared with those obtained using cooled copper. The superconductive properties decrease with increasing frequency so that any of these materials will show theoretical advantage, contrasted to cooled normal conductors, only up to a certain crossover frequency. Therefore, results must also be compared to those available with other competing approaches, such as dielectric resonators and active filters. It should be noted that niobium has been used (at 4 degrees K) to build cavities, guiding structures and other microwave devices for many years. However, the history of superconductors as an impact technique for the microwave field will not be written at 4 K. Rather, positive answers in the next few years, to the questions asked above, will change forever the course of our society, let alone filter design activity.

It is just too soon to be sure.

Conclusions

This paper has not attempted made to cover the entire filter field. Rather, it has highlighted certain recent high impact technologies: desktop PC network simulations, active implementations of previously passive design approaches and the

exciting potential of superconductivity. The PC can make the mediocre designer look like a synthesis expert and can improve productivity by reducing lab time. However, someone must do the PC programming. This person must now be a multi-disciplinary specialist, knowledgeable in field theory, network topology, synthesis and mechanical engineering. In common with other areas of modern life, use of the computer to supplement expertise creates the need for even more expertise.

Active filters may alleviate the shortcomings now inherent to the use of filters in MMIC and similar technology. Active circuitry results in equivalent high-Q components. Various configurations are available, with associated problems of varying degrees. Much work is under way in this area, with an MTT workshop planned in the near future. Superconductivity is yet the big unknown: promises, promises but as yet . . . not too much. It must be noted that superconductors and active filters may compete in the planar world. In closing, I ask if a critical evaluation of technology and its impact on society is not in itself a rather "selective" function that suppresses unwanted excursions, or oscillations, into dead end areas? Is not, then, "all the world a filter"?

About the Author

R. V. Snyder is the President and founder of RS Microwave, a well-known manufacturer of RF and Microwave Filters. He is the author of numerous papers on the subject of filters and couplers and the holder of 10 patents. He serves the IEEE as Section Vice-Chairman in North Jersey and as Chapter Chairman for the MTT and AP Societies. He is a reviewer for the various MTT publications, teaches various filter and network courses, and serves MTT-AdCom on special assignments.

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Trends in Solid-State Microwave and Millimeter-Wave Technology

K. J. Slegler, R. H. Abrams, Jr., and R. K. Parker
Electronics Science and Technology Division
U.S. Naval Research Laboratory
Washington, D.C. 20375

The views and opinions of the authors expressed herein do not necessarily state or reflect those of the United States Government, the Department of Defense, or the Department of the Navy and shall not be used for advertising or product endorsement.

Background by Kris Agarwal

This article is an expanded version of a presentation that Dr. Ken Slegler of NRL was to deliver at the 1990 IEEE MTT International Symposium in the GaAs Technology Workshop. Due to family circumstances, Ken could not make the trip to Dallas but has since agreed to write the following article with Dr. Abrams, Jr., and Dr. Parker of NRL. We are very appreciative to them for their efforts which allow our Members to be more informed about Solid-State Microwave and Millimeter-Wave Technology.

Introduction

Recent geopolitical developments and their impact on civil and military economies are expected to play a major role in charting the course of the entire microwave components industry — both solid state and vacuum electronics — during the 1990's. For several decades the Department of Defense (DoD) has provided development funding to this industry in addition to purchasing its finished products. Today, DoD is currently in the process of adjusting future weapons needs to accommodate a rapidly changing world environment. As a result, the future health and well-being of the microwave components industry will require a well-grounded understanding of doing business in the 1990's where technology investment in the military sector is facing major uncertainties. The purpose of this paper is to offer up several answers to the all-important question for the solid-state microwave components community — "What lies beyond for the rapidly-changing microwave technologies in silicon, GaAs, and InP?" — based on forecasts and several observations of the relationship between the microwave industry and DoD over the past 15 years.

1990 Microwave/Millimeter Wave Technology

In the broadest sense the major changes that have driven the military microwave industry are based on a few devices: the Gunn diode, the silicon mixer diode, the silicon bipolar transistor, and the GaAs FET (field effect transistor) on the solid-state side and, on the vacuum-electronics side, the TWT (traveling wave tube), and the crossed-field amplifier (CFA). Today, the military microwave/millimeter-wave business situation is dominated by three well-developed device technologies: the TWT (accounting for about two-thirds of power tube sales to the military), and the silicon bipolar transistor and GaAs MESFET, both of which can be monolithically integrated to form a variety of useful circuit functions. Figure 1 shows the frequency range expectation of the well-known monolithic solid-state circuit technologies of most interest today based on

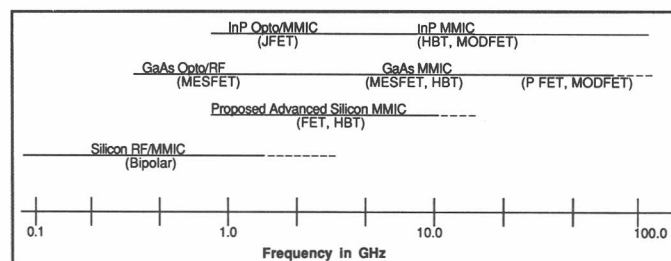


Figure 1.
1990 View of Dominant Solid-State MMIC Technologies as a Function of Frequency.

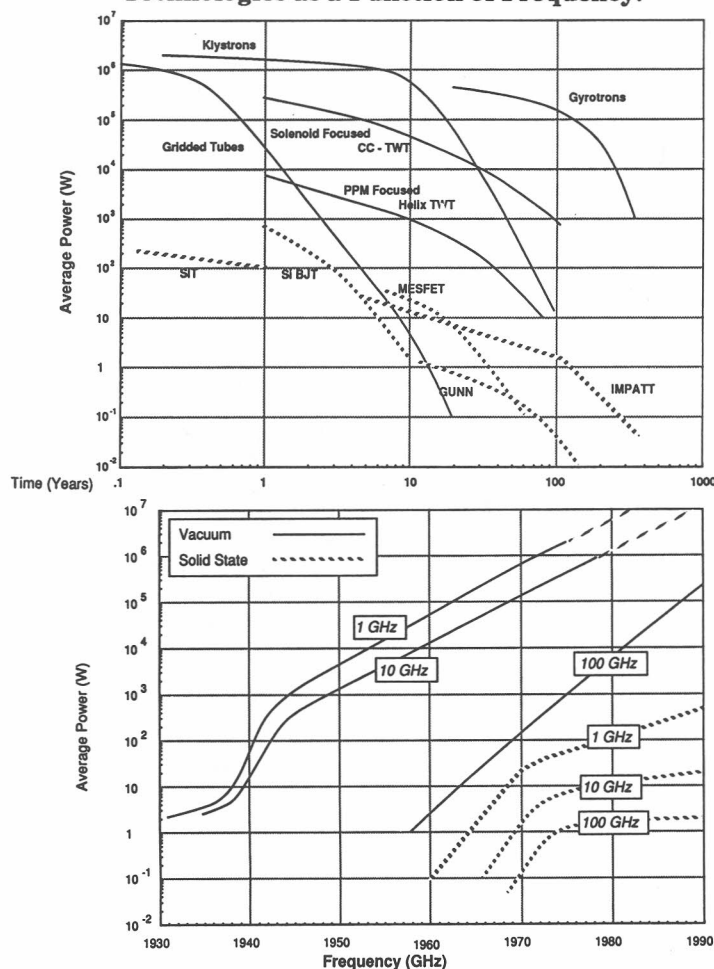


Figure 2.
1990 View of Dominant Vacuum and Solid-State Power Source Technologies and Historical Growth.

their low noise, wide bandwidth, or power performance. In addition, silicon, GaAs, and InP discrete devices provide both two- and three-terminal sources of medium power in the frequency range from 1 to 100 GHz. Figures 2 and 3 show the current limits for solid-state power devices along with equivalent vacuum electronic device limits.¹ Note that vacuum electronics technology meets the power needs for many military systems; in certain parts of the power-frequency regime there is overlap with solid-state approaches, but solid-state technology has definite power limitations and is taxed by low efficiency in meeting system power needs. Future higher-power solid-state devices, such as those envisioned from silicon carbide and diamond, offer some possibility of alleviating the efficiency problem. On the other hand, some form of vacuum electronics device miniaturization could prove equally attractive for sys-

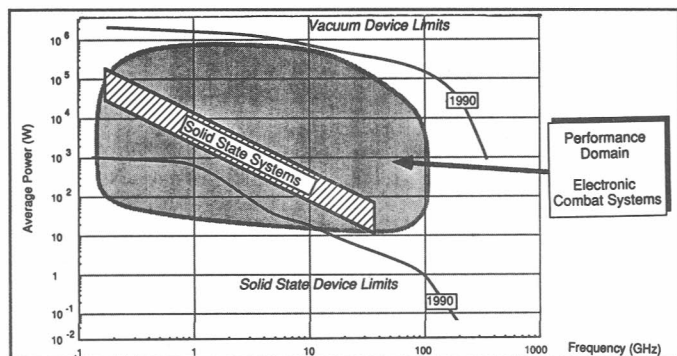


Figure 3.

**Performance Requirements for Military Systems:
Limits of Device and Combined Performance
(From Reference 1).**

tems which are size, volume, and efficiency intensive. Systems of the future could potentially be made more affordable and effective by using a hybrid approach that involves both solid-state and vacuum electronic technologies.

From the Past into the Future

Several projected trends that may impact the industry's future should be highlighted for the reader. Sales of both vacuum electronic power devices and solid-state amplifiers to DoD are shown in Figures 4 and 5 for the period 1950-1993.¹ The years 1990-1993 are projections which estimate a shrinking DoD market as the result of recent occurrences in eastern Europe.^{1,2} Note that vacuum electronics sales as a percentage of the DoD procurement budget has varied by only a factor of about two (0.6% to 1.2% over a four-decade period which includes the Korean and Vietnam conflicts). Solid-state sales began about 1970, with the steep rise in the 1980's representing, for the most part, the insertion of GaAs FET technology. Figure 4 forecasts that the 1990's ratio of solid-state sales to DoD procurement levels out at about 0.5%, not much different

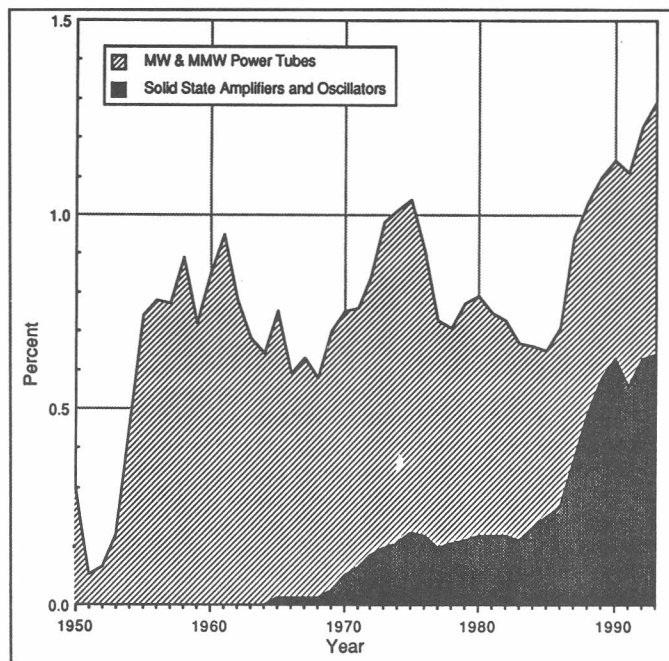


Figure 5.

**Military Sales Divided by Total DoD System
Procurement (From Reference 1).**

than that of the 1950-1990 period for power tube technology. If flat sales continue into the 1990's, the inference is that technologies such as GaAs MMIC may *not* have a drastic impact on the overall sales of solid-state components to DoD. This situation could change if, for instance, (1) DoD invests in sufficient *new* systems that exploit advanced vacuum or solid-state devices or (2) a commercial-volume market emerges for new microwave technologies. The former possibility is not expected; the latter possibility is considered below.

High-volume markets represent a new direction for the military microwave industry, the MMIC being a case in point. Consider that some in the microwave solid-state industry believe that the need for high volume will occur automatically as soon as MMICs are fabricated. But the reality is that the industry may not be able to cope with MMIC insertion demands of the 1990's which tend to impose short lead times on component manufacturers. Another area of potential misunderstanding surrounds the often-cited \$75.00-or-less military MMIC chip. Some industry representatives cite the projected availability of this chip with confidence. In reality volume needs to reach 1×10^7 chips/year/line to comfortably reach the \$50-\$75 chip price level. The commercial world can reach this volume level, for example, with automotive radars (collision avoidance, traffic control, etc.) and VSATs (Very Small Aperture Terminals). But the military market place is much less focussed in any given application area such that volume building by any means becomes a critical issue. In order to build MMIC volume the military microwave industry needs to focus on increasing the necessary learning to reach steady insertion into military systems, not to lower MMIC costs. Cost reduction will come later. The microwave component industry, to remain most viable, needs to consider the slow and careful transition from the handcrafted product to the manufactured product during the 1990's.

What's New and Coming?

Competitive industries of the 1990's need to pay attention to the global economy where products continuously increase their value-added content. In other words industries must be flexible in responding to the needs of a changing world by

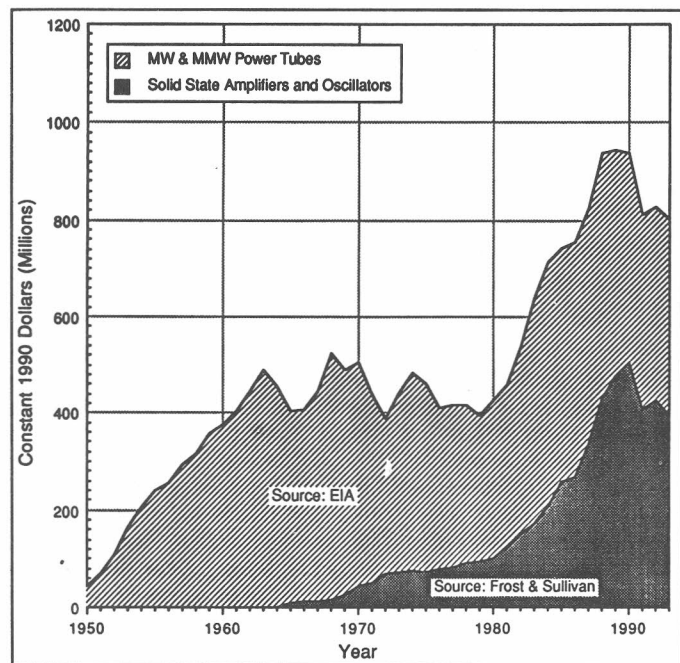


Figure 4.

**Military Sales of Microwave and Millimeter Wave
Amplifiers and Oscillators (From Reference 1).**

offering products which keep them healthy by building application bases. The microwave industry is no exception in that it too must develop manufacturing technologies capable of incorporating small changes into either standard and/or application specific products. The military market has traditionally sustained small volume, handcrafted parts and has limited success with high volume, application specific parts for reasons that go beyond the scope of this paper.³ Commercial vendors can build volume with both standard and application specific silicon digital parts by using flexible manufacturing techniques assisted by computer-aided design. The same opportunity exists to build both commercial and military microwave circuit volume using modern day MMIC foundries and microwave CAD techniques.

Now to address some of the changes projected to impact the microwave industry during the 1990's. These are:

Emergence of Volume Markets

- Development of advanced CAD/CAE/CAM for quick turnaround of parts and first-pass design success
- Miniaturization of circuit functions requiring massive space today, such as filters, switches, circulators and multiplexers
- Merging of microwave and optoelectronic circuits for microwave applications such as phased arrays
- Availability of high-temperature microwave circuits for aircraft and automobile engine control
- Availability of many types of MMICs with MSI integration levels

Miniaturization

- All of the above cited for volume markets
- Emergence of vacuum microelectronic devices for up to 100 watt broadband power requirements and for receiver protection circuits
- Wafer-scale integration of Si and GaAs MMICs
- Three-dimensional packaging of circuits for very high MIC integration
- Miniaturization of conventional vacuum power devices (see microwave power module initiative)

These trends can in turn be reinterpreted in terms of projected supporting activities in materials, devices, and circuits shown below.

Materials

- Vertical Zone Melt semi-insulating GaAs substrates 3-in or more in diameter with uniform defect densities less than 10 cm^{-2}
- Silicon carbide and diamond electronic-grade thin film technology
- High-quality, iron-free, InP semi-insulating substrates
- High-quality SIMOX (silicon) technology for microwave devices and ICs with performance to 12 GHz or more
- Wide range of high temperature superconductor films

Devices

- HBTs using GaAs, InP, and Si/Ge materials
- SiC and diamond high-temperature RF electronic devices
- Quantum-based devices for non-linear functions
- Small, low-voltage vacuum electronic and microelectronic devices

Circuits

- Miniature filters, circulators
- Co-planar MMICs to MSI complexity
- Very broadband MMICs and vacuum devices
- High-temperature superconductor passive components

- Wafer-scale integration
- Very high levels of module integration
- Shared aperture wideband circuits and modules

Finally, we need to look at some applications, especially commercial, which can *pull* all of this activity

- | | |
|------------------------|---|
| • Silicon | Very-low-cost microwave circuits to 18 GHz, glue for 3D circuits miniaturization and microwave-digital processors |
| • GaAs | Commercial MMICs: engine control, HDTV, atmospheric sensing, point-of-contact sales (VSAT), personal security |
| • InP | Millimeter-wave communications, personal security, personal safety, space surveillance/satellite networks, advanced automobile cruise control |
| • SiC, Diamond | On site, high temperature aircraft/automobile electronics DC to low microwave ultra-reliable radiation tolerant devices and circuits |
| • Field Emitter Arrays | Small intermediate-power microwave source for phased arrays, receiver front-end protection |

What's New and Coming?

The Navy has a variety of initiatives that address current needs in its microwave electronics operational capability. Only the most salient initiatives can be mentioned here. They are:

- vacuum microelectronics
- advanced silicon MMICs
- miniaturized filters and multiplexers
- high-dynamic-range front-ends
- refractory semiconductor devices
- bulk semiconductor growth
- HTSSE space experiment
- advanced computational techniques for vacuum electronic devices
- advanced phased arrays
- microwave power module

Table I gives more details on these initiatives. Note that the principal benefits can be grouped into several major areas: miniaturization; wide dynamic range, anti-jam capability; and shared radar/communications or radar/surveillance functions. One device, the HBT, is a potential major player in at least five areas and is expected to make a major impact on the next generation of Navy electronic systems beyond the year 2000. Refractory semiconductors and miniaturized vacuum technology will most probably have an extended impact that continues well after the year 2000. Other technologies such as advanced silicon and InP MMICs are seen as having an important effect on technology fallout as early as 1995. InP-based heterostructure technology is expected to supersede much of today's GaAs-MESFET-based technology and certain types of GaAs-based HBT and MODFET technology.

Conclusions

The 1990's and beyond represent a new, uncertain era for the solid-state microwave and millimeter wave components industry. The uncertainty mainly lies in the area of DoD weapon system purchases. The newness of the era stems mostly from the challenges of developing commercial applications, from innovative vacuum-electronics technology, and of developing advanced military components, such as shared-aperture modules and burnout-free wide-dynamic-range re-

ceivers. These challenges will require manufacturing and design skills far beyond today's capabilities. It will also require the development of new materials such as SiC, diamond, high temperature superconductors, and structures for vacuum microelectronic devices. The challenge is there. Can the industry respond?

About the Authors

Kenneth J. Slegler

Kenneth J. Slegler received the BSEE and MSEE degrees from Case-Western Reserve University, Cleveland, Ohio, in 1962 and 1963, and the Ph.D. degree in Electrical Engineering from Carnegie-Mellon University, Pittsburgh, Pennsylvania, in 1971.

Since joining the Naval Research Laboratory, Washington, DC, in 1971, he has made contributions to a wide range of technologies and devices including PbS-PbS(1-x)Se(x) heterostructure lasers, GaAs FETs, InP FETs and GaAs MMICs. More recently he is engaged in SiC FET technology and MIMIC CAD activities. He has also worked with GaAs FET process science, GaAs FET reliability and improved metallizations for GaAs and InP FETs.

Dr. Slegler is currently the Head of the High Frequency Devices Section at NRL with responsibility for exploratory investigations of new microwave and millimeter-wave devices and ICs. In addition he is Project Manager for a substantial portion of the Office of Naval Technology exploratory device and IC effort in the RF/MW/MMW solid state area. He is a Senior Member of the IEEE and a member of the IEEE Electron Devices Society.

Richard H. Abrams, Jr.

Richard H. Abrams, Jr., received the SBEE degree from Massachusetts Institute of Technology in 1959 and the Ph.D. degree in Plasma Physics from the University of Maryland in 1970. His industrial experience includes thermionic energy conversion research at ThermoElectron Engineering Corporation and General Motors Research Laboratory. He has been active in the energy and environmental policy area, and has been a consultant to both government and corporate management on technical strategic planning.

Prior to joining the Naval Research Laboratory, he served as Chief Scientist of B-K Technologies, where he was engaged in assessments of various technologies, including the generation of high power microwaves.

Among his foremost interests since joining NRL in 1988 has been the analysis of policies affecting the vacuum electronics

technology. He is currently the Head of the Sources and Fabrication Section of the Vacuum Electronics Branch of NRL's Electronics Science and Technology Division, in which capacity he is responsible for the direction of Navy research programs in vacuum microelectronics and in thermionic and secondary electron emitters. He also serves as the NRL manager of the Ultra-Low-Noise Crossed-Field Amplifier program.

Dr. Abrams is a member of the American Physical Society and the Sigma Xi honorary fraternity.

Robert K. Parker

Robert K. Parker received the BS degree in Physics from Allegheny College, Meadville, Pennsylvania, in 1964; the MS degree in Space Physics Engineering from the Air Force Institute of Technology, Wright-Patterson AFB, Dayton, Ohio, in 1966; and the Ph.D. degree in Nuclear Engineering from the University of Mexico, Albuquerque, in 1973.

From 1964 to 1972 he served in the U.S. Air Force as a scientific project officer. Since then he has been with the Naval Research Laboratory, Washington, DC, where he has been actively engaged in a study of the science and technology associated with the generation of coherent radiation in nonneutral plasmas.

He is the author of numerous papers in plasma physics, vacuum electronics and accelerator technology.

In 1981 he formed and is currently the Head of the Vacuum Electronics Branch in the Electronics Science and Technology Division in which topics of interest include such fields as the generation of coherent radiation from UHF to the far infrared, high brightness electron beam optics and computational techniques for modeling electronic devices.

He is also the Navy member of the DoD Advisory Group on Electron Devices and a member of the Executive Board of the Air Force Advanced Thermionics Research Initiative (ATRI) program at the University of California at Los Angeles.

Dr. Parker is a member of the IEEE and has served on the Executive Committee of the Nuclear and Plasma Science Society, Plasma Science and Applications Committee, the Plasma Physics Division of the American Physical Society, and Sigma Xi. He is currently an Associate Editor of the IEEE Transactions on Electron Devices.

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Table 1
Some Navy Initiatives Focused on the MMW/MMW Industry

INITIATIVE	OBJECTIVE	BENEFITS
Bulk Semiconductor Growth	To develop high quality GaAs and InP semi-insulating substrates for the electronics industry	+ Very low dislocation densities + Removal of Cr (GaAs) and Fe (InP) + 3"-6" substrate diameter + Low cost, manufacturable
Vacuum Microelectronics	Develop small efficient low-voltage power devices which exploit the strengths of both solid state and vacuum electronics while avoiding the weaknesses of these technologies	+ High performance, small, affordable millimeter wave power amplifier + Broadband power in the 10-100 watt range + Exceptional radiation hardness + Mass production
Microwave Power Module	Develop small efficient high volume power modules by integrating solid state and vacuum electronics technologies. Power modules respond to needs that tax an all solid state or all vacuum electronics approach	+ Enhanced architectural design flexibility + Reduced size, cost, weight of future system + Improved system noise performance + Mass production
Advanced Computational Techniques for Vacuum Electronic Devices	To develop three-dimensional fully-electromagnetic computer codes and design tools for vacuum electronic device design	+ Reduced design costs + Quick performance optimization + Low noise CFA improvement
Superconductivity Research Program – Space Experiment (HTSSE)	To test and insert high temperature superconductor microwave products for space systems and to develop space uses for high temperature superconductors	+ Radiation hardness + Test results from superconducting materials in space (information) + Stimulate application oriented device development
Refractory Semiconductor Devices	To improve the power output, reliability and high temperature capabilities of current solid state power devices. To grow high quality electronic films of SiC and diamond	+ Radiation hardness (SiC, diamond) + Increased anti-jam capability + Chemical inertness for ruggedness and relaxed packaging requirements
Advanced Silicon MMICs	To extend silicon MMIC technology to X-band or higher. To exploit recent advances in SIMOX technology and Si/GE HBT technology	+ Very low cost MMICs + Single chip integration of digital and MMIC functions + Mass production
High Dynamic Range Front-Ends	To significantly improve the dynamic range of receiver front-ends, mostly with MMIC technology	+ Spur reduction + Increased probability of friend or foe detection + Mass production
Microwave Filters and Multiplexers	To miniaturize and replace many of the bulky filters, circulators and waveguide circuits currently in use, MMIC and ferrite technology	+ Reduced size and weight + Potential for mass production + Wider bandwidth operation + Improved selectivity
Advanced Phased Arrays	To develop the next generation of T/R modules with shared electronic functions (Radar/EW, Radar/Communications, etc.)	+ Increased electronic agility + Low sidelobe emissions + Minimize prime power and system cooling

INTERNATIONAL SCIENTIFIC MEETING

MICROWAVES IN MEDICINE '91

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April 8-11, 1991
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ANNOUNCEMENT AND CALL FOR PAPERS

The First International Scientific Meeting organized jointly by Yugoslav IEEE MTT Chapter, IMTEL — Institute of Microwave Techniques and Electronics (former Institute of Applied Physics) and Scientific Committee of Serbia.

The main intention of the meeting is to provide a major international forum for presentation and exchange of recent progress in the application of microwave technology in medicine (diagnostic and treatment equipment) as well as to open and widen discussion of microwave radiation hazards in medical environment.

The official language at the meeting will be English.

Main topics include, but are not limited to:

- Medical Applications of Microwave Fields
- Microwave Radiation Hazards in Medical Practice
- Microwave Radiation Protection and Safety Standards

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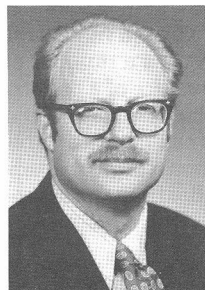
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Microwave Applications in Cancer Therapy, Cardiology and Measurements Techniques: A Short Overview



*Arye Rosen
MTT-10 Chairman, Biological Effects
and Medical Applications*

Abstract

In the last ten years, microwaves have been used increasingly in the areas of diagnostic and therapeutic medicine. For example, passive radiometry is an important tool for measuring the temperature of subcutaneous regions of the human body non-invasively, with the potential of detecting deep seated tumors. Microwave hyperthermia, meanwhile, is currently in use in many medical centers in the treatment of cancer as an ancillary modality to radiation therapy and chemotherapy; and microwave balloon angioplasty (MBA), a modality currently being tested in animals, combines heat and mechanical force (balloon) to open occluded and partially occluded arteries. The following short discussion concentrates on the topics dealt with most often in material published in IEEE MTT Society Transactions. The area of medical applications of microwave imaging is not included.

Introduction

The properties of microwaves in human tissue depend on the tissue water content: the greater the water content of the tissues, the smaller the depth of penetration of microwaves into them. This property makes microwaves useful in many medical applications.

Microwaves are widely used to produce hyperthermia in cancer patients. Superficial or subcutaneous tumors are usually heated by means of an external microwave antenna. Deep seated tumors can be heated by means of small coaxial antenna that are inserted into the patient via either natural or surgically produced cavities.

Research into the use of microwaves in cardiology has led to the area of microwave balloon angioplasty, which combines conventional balloon angioplasty techniques (balloon catheters used to increase the coronary blood flow in atherosclerotic vessels) with microwave heating to help enlarge the lumen of narrowed arteries, and reduce the occurrence of restenosis.

In the diagnostic area, the feasibility of reconstructing non-invasively temperature distribution in a biological structure from multi-frequency radiometric data has been verified by both theoretical analysis and experimentation. This temperature information is currently being utilized as an important modality in the early detection of cancer.

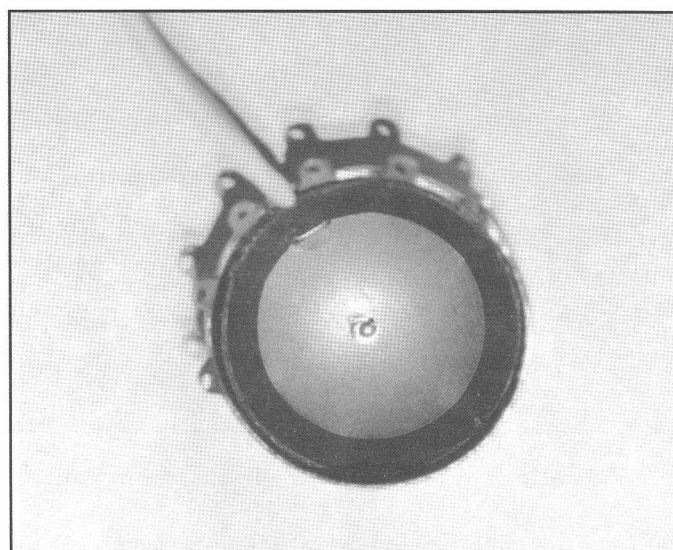


Figure 1.
Microwave applicator used in the treatment of choroidal melanomas.

The Application of Microwaves to Cancer Treatment Examples^{1,2,3,4,5,6,7}

Patch Applicators for Treating Choroidal Melanoma

Figure 1 is a photograph of a microwave applicator used in the treatment of choroidal melanomas. (Choroidal melanomas are the most common ocular malignancies in adults. They are tumors growing from the middle, vascular layer of the eyeball.) The applicator consists of a semi-rigid cable feeding a patch antenna that is printed on a bowl shaped piece of Duroid. During hyperthermia treatments the applicator is positioned on the diseased eyeball, the center of the applicator being aligned with the center of the tumor being treated.

Miniature Coaxial Applicators for Treating Deep-Seated Tumors

Figure 2 is a photograph of a simple miniature coaxial applicator (with integral thermocouple) for treating a variety of deep-seated tumors. The applicator consists of a length of semi-rigid copper coaxial cable with a radiating antenna that is formed by removing a short length of the outer conductor at

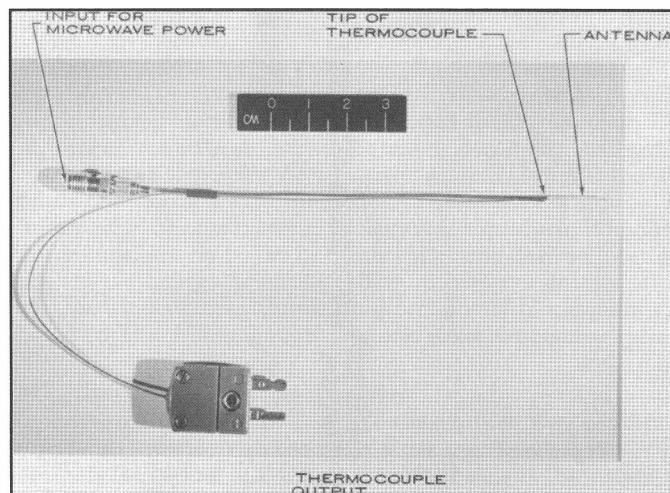


Figure 2.
Miniature coaxial applicator.

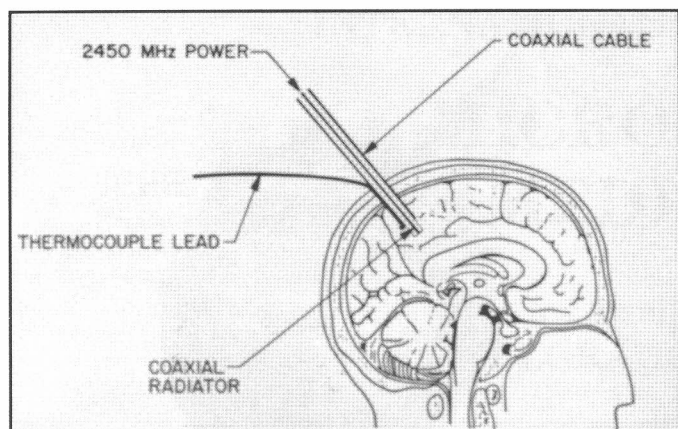


Figure 3.

Schematic of applicator in the brain of a patient.

the tip of the cable. (Other types of antennas commonly used with miniature coaxial cables include gap antenna, helical antenna, etc.) During hyperthermia treatments, one or more of these miniature applicators are inserted into the tumors. Figure 3 illustrates how miniaturized applicators can be used to heat deep-seated brain tumors.

Large Coaxial Applicators for Treating Cancer of the Prostate

Figure 4 is a photograph of a large coaxial applicator used for treating cancer of the prostate (as well as benign prostatic hyperplasia). The applicator consists of a section of coaxial

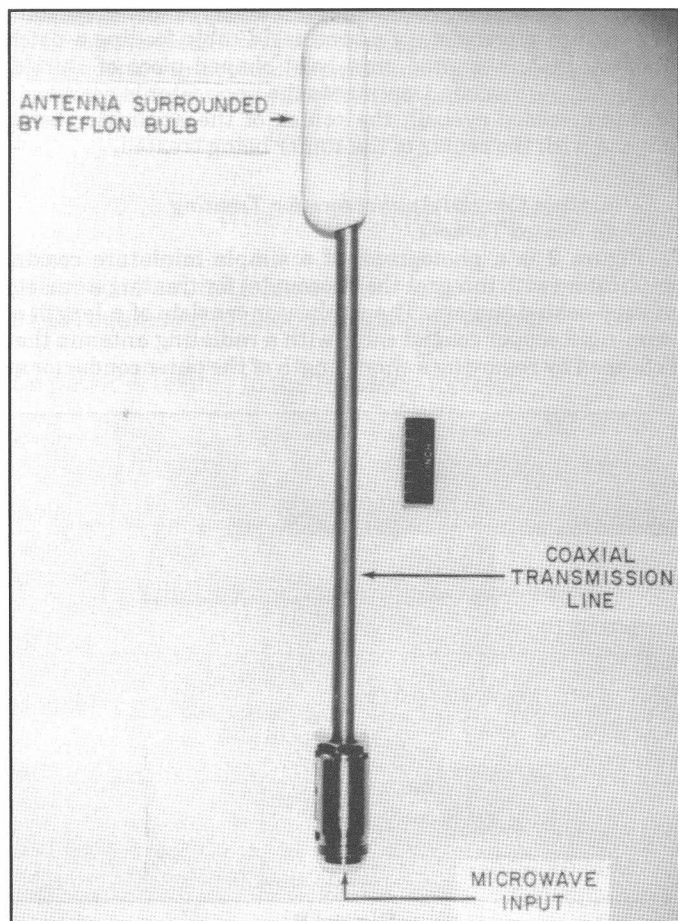


Figure 4.

Coaxial applicator for treating prostate cancer.

cable with an antenna at its tip. An asymmetrically shaped teflon bulb surrounds the antenna. During hyperthermia treatment, the applicator is inserted into the rectum of the patient, and the antenna is placed adjacent to the prostate gland. (The asymmetric teflon bulb helps reduce the heating of the uninvolved parts of the rectum. Water or air cooling is often added to further protect the walls of the rectum.)

Microwave Applicator for Transurethral Hyperthermia of Benign Prostatic Hyperplasia (New Approach)

Benign prostatic hyperplasia (BPH), causing urinary outlet obstruction, is a common disease among aging men. The objective of treating BPH with microwave hyperthermia is to alleviate the symptoms of urinary obstruction.

An applicator for heating the prostate gland using a transurethral approach is currently being utilized in several centers around the country. This technique uses a number of microwave antennas attached to the outer surface of a balloon type urological catheter. The balloon catheter assures the reproducible positioning of the antennae in the prostatic urethra. This new technique might provide a non-surgical alternative to transurethral prostatectomy for relief from the symptoms of benign prostatic hyperplasia.

Percutaneous Transluminal Microwave Balloon Angioplasty and Microwave Ablation^{8,9,10,11}

Percutaneous transluminal balloon catheter angioplasty has become a popular alternative therapy to open heart surgery since it carries less risk and is less expensive than surgery. This method involves the insertion of a catheter, tipped by a deflated balloon, into the lumen of an artery partially occluded by plaque. The balloon is then inflated to enlarge the lumen and thus increase coronary blood flow.

A microwave balloon angioplasty (MBA) catheter is utilized (Figure 5). Microwave energy produces heat at the end of the catheter, causing softening of an arterial plaque prior to or during inflation of the balloon. This process may result in more effective and longer lasting dilation of previously stenosed arteries. Furthermore, there is a thermal compression of the three layers of the artery. Such thermal compression has potential beneficial effects, including a decrease in arterial elastic recoil.

The microwave system consists of a 2450 MHz signal generator (capable of delivering up to 100 W), a directional coupler, and two power meters to measure forward and reflected power. A thin flexible coaxial cable, 0.023 in. in diameter, fits within a conventional balloon angioplasty catheter and is terminated by a radiating antenna. The major physical constraint on both the antenna structure and the transmission

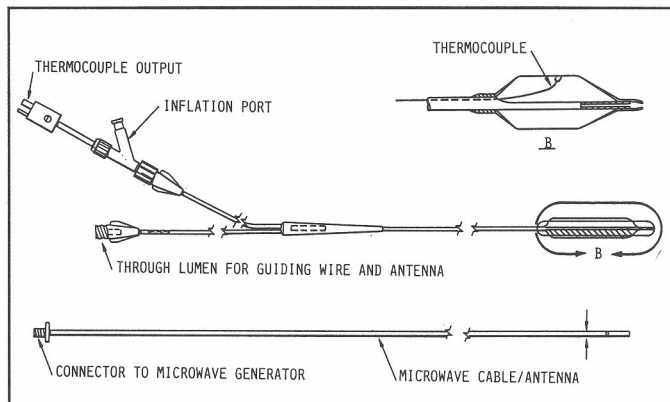


Figure 5.

**(a) Balloon catheter;
(b) Microwave delivery system.**

line is the diameter of the catheter through-lumen. The dielectric loading effects of the tissue and the balloon inflation fluid are other factors that affect the selection of the antenna dimensions, tending to substantially reduce both dimensions as compared to free-space conditions.

Animal Model

Initial studies were performed on the external iliac artery of normal New Zealand white rabbits, Figure 6. Another series of studies was performed on New Zealand white rabbits which had atheroma induced by a cholesterol and fat supplemented diet complemented by endothelial denudation of the iliac artery. This model was chosen since the iliac artery in this rabbit has dimensions which approximate the size of human coronary arteries.

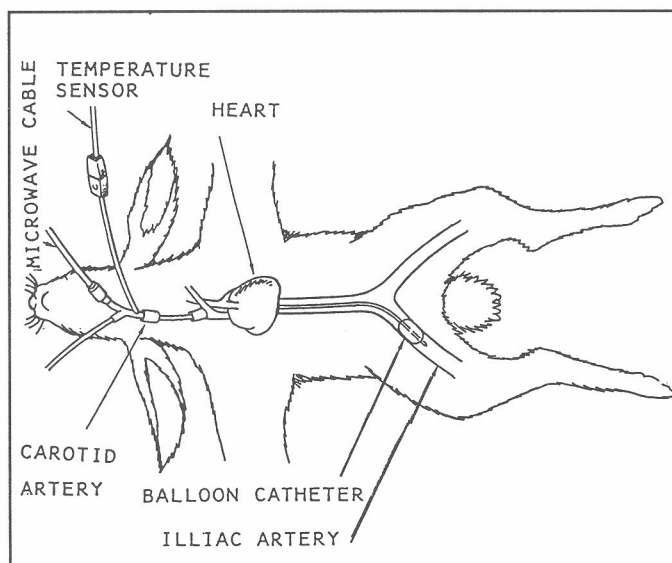


Figure 6.
Catheter inserted in rabbit model.

Normal and Atherosclerotic Models

Pathologic changes found in the media of the normal model ranged from inflammatory cell infiltration to loss of smooth muscle cells with medial thinning. Variable degrees of intimal proliferation were seen. A linear relationship between peak or mean temperature and injury to the media was observed. The severity of vessel injury was not altered by the balloon inflation pressure. An inverse relationship between intimal proliferation and medial injury was demonstrated at one week following the procedure.

Figures 7 and 8 depict an example of the effect of microwave heating on an atherosclerotic artery. Figure 7, a pre-angioplasty angiogram, and Figure 8 show the marked difference in the results following balloon angioplasty (left iliac artery) and following microwave angioplasty (right iliac artery). The additional modality of microwave energy results in enhancement of the immediate results, in essence the creation of a biologic stent. A larger diameter of the treated artery thus results. Further evaluation is required for analysis of the long term effects of this modality.

Catheter Ablation of Myocardial Tissue

A new medical procedure for the treatment of tachycardia (rapid heartbeat) or cardiac arrhythmia utilizing microwave energy is currently being investigated. This technique uses a catheter which includes a flexible coaxial transmission line terminated by an antenna. The antenna is introduced into a chamber of the heart, and brought into contact with a wall of

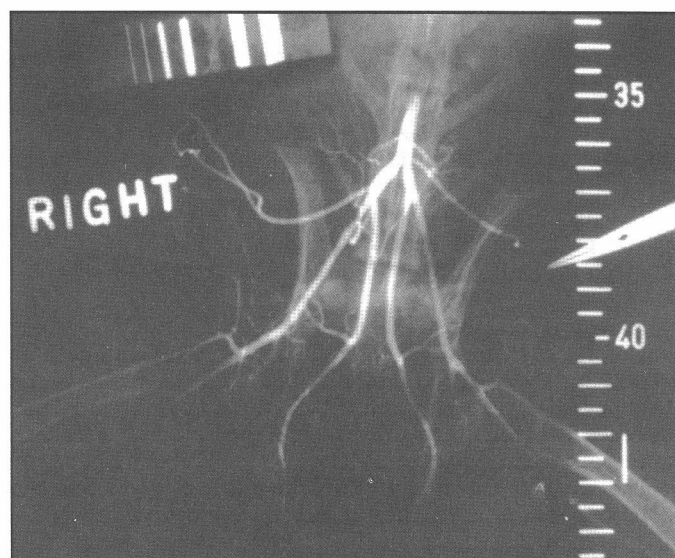


Figure 7.
A pre-angioplasty angiogram.

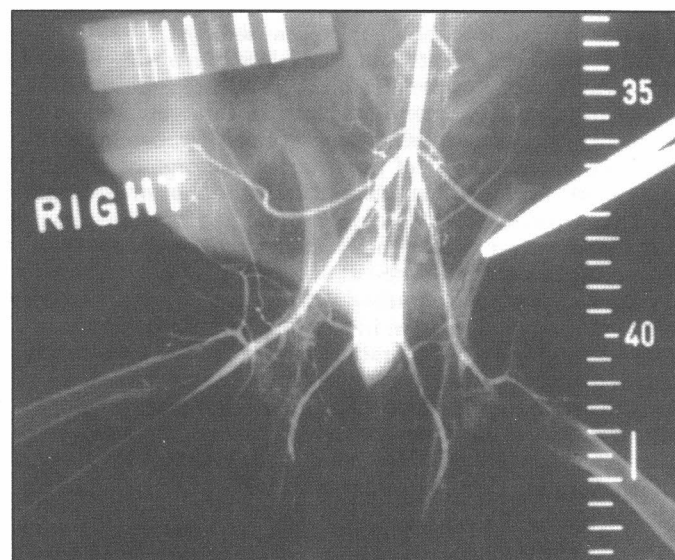


Figure 8.
Results following balloon angioplasty (left iliac artery), and microwave balloon angioplasty (right iliac artery).

the heart. Action potentials generated by the heart are coupled to a standard electro-cardiograph apparatus for display. The position of the antenna in the chamber of the heart is adjusted with the aid of the displayed action potentials until the antenna is in contact with the region to be ablated or injured as indicated by its characteristic electrical signature. When the antenna is adjacent to or in contact with the desired location, microwave energy is applied. The microwave energy is increased slowly, until the desired amount of blockage of the bundle of His or damage to the ectopic focus has been achieved.

Microwave Radiometry^{12,13,14}

Research in the area of microwave radiometry continues around the world, with the hope of designing better receiving systems (including antennae) in more than one frequency, in order to increase temperature measuring accuracy.

Radiometry is defined as the measurement of natural electromagnetic radiation or emission from the body at micro-

wave frequencies. It may be applied to the detection and diagnosis of pathological conditions in which there are disease-related temperature differentials, such as in the early detection and diagnosis of breast cancer. Other applications, such as in the detection of tumors in other sites, and in monitoring temperature during hyperthermia are currently being investigated.

The antenna has become the critical component limiting system performance, and further development is required if this technology is to be used in the early detection of cancer.

Microwave Monitoring System¹⁶

The use of microwaves to monitor vital life-signs, such as respiration and heart-beat for example, was researched in the early part of the 1980's. Papers in this area have been appearing recently in the literature, reporting success where modern processing techniques are utilized.

The basis of the non-invasive monitoring devices is the motion detection capability of simple microwave radar-like circuits in which phase displacements between transmitted and reflected signals can be related to physical movements of the reflecting surface. To monitor the pulsating motion of the heart or that of any artery or organ of the human body with a radio signal, it is necessary to sense either the phase-varying reflections from the body surface caused by the underlying organ action, or to directly monitor this action by causing most of the radio signal to penetrate the skin, fat or muscle tissue which overlies the artery or organ of interest. Microwave frequency signals are most appropriate for use since the physical displacements of the arteries and organs, although quite small, are significant in relation to the short wavelengths of microwave signals which are generally in the order of centimeters in air and further reduced in tissue by the dielectric properties of the tissue.

Researchers have reported on the use of microwaves to measure chest wall motion in response to left-ventricle activity.¹⁴ Others have demonstrated the use of microwave Doppler radar to monitor the movement of arterial walls, from which the pulse rate could be clearly determined.¹⁵ Measurement of microwave attenuation in the human torso,¹⁶ electromagnetic wave effects on biological materials and systems,¹⁷ mapping of internal organs,¹⁸ or diagnosis of pulmonary edema¹⁹ was also reported.

Conclusion

New ideas for the utilization of microwave energy in medicine are currently being investigated. These ideas have applications in areas such as urology, cardiology and ophthalmology. The more mature microwave technology, with applications to cancer therapy and temperature monitoring systems, is currently being used. Microwave therapy for cancer treatment is utilized in conjunction with other therapies to increase potency of treatment.

Acknowledgments

I wish to acknowledge the support of Fred Sterzer, who offered constructive comments and provided much of the material pertaining to cancer therapy. The invaluable contribution of Daniella Rosen is also gratefully acknowledged.

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MTT-1 Report:

Electromagnetic Design of Passive Structures

Emerging Technology in Microwave CAD



by James C. Rautio
Sonnet Software, Inc.
101 Old Cove Road, Suite 100
Liverpool, NY 13090
(315) 453-3096

The 1980's was the decade of circuit theory based microwave design. The 1990's promise to be the decade of electromagnetic microwave design. Once viewed as primarily an academic exercise, electromagnetic software is now starting to enter the mainstream of microwave design.

As electromagnetic software becomes available, we find ourselves in a situation similar to that which we experienced in the late 1970's with circuit theory based software. The software is new and unfamiliar. We find high expectations sometimes met by disappointment. We find a new technology that we must learn and we experience the thrill of discovery as we find new ways to do more for less.

Disappointment

First, the disappointment. Electromagnetic software will never replace circuit theory based software. Treating a structure in terms of voltages and currents will always be faster than treating it in terms of electric and magnetic fields. The place of electromagnetics is beside circuit theory, working in tandem, enhancing the capability provided by circuit theory. Electromagnetic software should be invoked only when necessary, and then only on the portions of a structure which need it.

The Wall

The problem is what we call "The Wall." When the circuit is simple enough, it is on the fast side of the wall. Then, as complexity increases, at some point, The Wall is encountered. Now, analysis time becomes excessive and even small increases in complexity produce excessive increases in execution time. Thus, given a specific software/hardware combination, there is a strong upper limit on the complexity that can be handled. With present day technology, this limit excludes the analysis of a complete circuit.

There are hundreds of electromagnetic techniques, with most still in the academic research phase. A few have transitioned into a commercial environment, having developed the required user interface, as well as support and marketing channels.

Not Competitors

Surprisingly, different electromagnetic techniques are rarely direct competitors. Rather, each tends to shine for its particular class of problems while performing poorly, if at all, when outside of that class. In other words, just any electromagnetic analysis is unlikely to be the answer to your problems. Rather, you must choose the analysis which "shines" for you. No one product can solve all problems.

EMSIM, EEsof

As of this writing (just after the MTT Symposium), there are several commercial entries. The first major commercial electromagnetic microwave offering was EMSIM from EEsof. EMSIM is a subsectional method of moments technique based on an approximate Green's function. The approximations are such that large scale coupling between components of a circuit can be evaluated relatively easily.

Viewed by microwave engineers, EMSIM is a 2-D analysis, in that only X and Y current is allowed. (In fact, current between thin layers is allowed; however, arbitrary 3-D structures cannot be evaluated.) On the other hand, an electromagnetic engineer sees 3-D fields and views EMSIM as a 3-D analysis (coax and waveguide are 2-D). We like to compromise and call EMSIM a 2½-D analysis.

EMSIM has been available for some time. We recommend that detailed evaluations of EMSIM be obtained from EEsof or from existing customers.

HFSS, HP and EMAS, MacNeal-Schwendler Corporation

At the symposium, both HP and MacNeal-Schwendler Corporation introduced a full 3-D simulator using finite elements (finite elements is a special case of the method of moments; however, it is usually treated as a separate technique). The HP simulator was developed by Ansoft and has been integrated with the HP CAE platform.

Both analyses are of a circuit in a box (the box is optional in the MacNeal-Schwendler product) and require a mesh filling the entire volume of the box. This volume filling mesh is the principle advantage of finite elements. Very arbitrary structures may be specified and evaluated. Finite element techniques shine with complex 3-D structures.

The volume filling mesh is also finite element's principle disadvantage. The entire mesh must be evaluated, even for planar circuits. This is the reason that subsectional techniques (such as EMSIM, above, and EM, next) can perform so much better on planar circuits. The subsectional techniques subsection only the metalization.

While HP usually refuses to comment on future products, they have announced that their finite element package will include loss on a future release (the MacNeal-Schwendler product already includes both loss and radiation), and that a planar finite element product is planned. The MacNeal-Schwendler product has over 1000 installed sites, while the HP product is just about to enter beta site testing. However, it is not all one sided. The HP product is directed towards the microwave market, while the MacNeal-Schwendler product is much more general. In other words, they are still learning about what a microwave engineer needs.

While the finite elements technique uses a very large (and sparse) matrix, the theory is simple. Thus we can expect more products along this line in the near future. The major effort in a finite element product is in the user interface. Since there are a large number of non-microwave finite element companies with well developed user interfaces, watch for more teaming arrangements, like the AP/Ansoft team.

EM, Sonnet Software

EM, like EMSIM, subsections only the metalization (not the volume), thus achieving an advantage (for planar structures) over a volume meshing technique. Unlike EMSIM, EM is a full 3-D analysis, allowing X, Y and Z current between all layers and to ground. The class of circuits for which EM shines are those which are fabricated on layered dielectric. Completely arbitrary structures must still be done with finite element techniques.

Em uses an exact, spectral domain Green's function and includes all losses, as desired. Em is optimized for predominantly planar circuits and interfaces directly to existing CAE software.

LINMIC+, Jansen Microwave

LINMIC+ was developed at Jansen Microwave and marketed (in the US) by Compact Software. A portion of LINMIC+ is similar to the Sonnet product, except that iterative solutions may be invoked and there is no loss. The LINMIC+ product also includes an impressive variety of non-electromagnetic tools also related to MMIC design (data base generation and non-linear analysis, to mention just a couple). As with EMSIM, this product has been available for some time. We recommend contacting Compact Software or existing customers for a detailed evaluation.

Future Product, Compact Software

Compact Software announced at the symposium that they are developing a product very similar to Sonnet's product. Development is currently in its initial stages.

Stingray, ArguMens

In the 2-D (transmission line) area, ArguMens has an impressive finite-element quasi-static analysis, Stingray. Taking advantage of the ability of finite elements to handle very arbitrary structures (this time in two dimensions), Stingray provides analysis of planar transmission lines with discontinuous dielectrics. Stingray is one portion of and interfaces to an impressive line of CAE products offered by ArguMens (U.S. distributor, Apogee Software).

Future Potential, UC at Boulder

Although no commercial products are yet available, keep an eye on University of Colorado at Boulder. Extensive work is underway on several electromagnetic simulators. They are also aware of the need for a good user interface and, with a consortium of microwave companies providing both funding and direction, such interfaces may be developed.

We have not discussed other important factors, such as price, required hardware configuration, availability, and support. Each software vendor should be contacted for this important, and often rapidly changing, information. Each product described is a complete (so called "full-wave") electromagnetic analysis, except as indicated. In addition, each product has, at a minimum, made a serious attempt at a user interface as well as at establishing support and marketing channels. The 1990's will be the decade of electromagnetic microwave design. Hold onto your seats!

Vendor Information

Each product is a trademark of the appropriate vendor.

1. EEsof, 5795 Lindero Canyon Road, Westlake Village, CA 91362. (818) 991-7530.
2. HP, contact local sales office.
3. Ansoft Corporation, Four Station Square, Suite 660, Pittsburgh, PA 15219. (412) 261-3200.

4. The MacNeal-Schwendler Corporation, 815 Colorado Blvd., Los Angeles, CA 90041. (213) 258-9111.
5. Sonnet Software, Inc., 101 Old Cove Road, Suite 100, Liverpool, NY 13090. (315) 453-3096.
6. Jansen Microwave, Neanderstrasse 5, D-4030 Ratingen 1, West Germany. (2102) 8 30 95.
7. Compact Software, Inc., 483 McLean Blvd. & Corner of 18th Ave., Paterson, NJ 07504. (201) 881-1200.
8. ArguMens, Microwellenelektronik GmbH, Bismarckstrabe 67, D-4100 Duisburg 1, West Germany. (0203) 3780930.
9. Apogee Software, 100 Dogwood Drive, Oakland, NJ 07436. (201) 337-0428.

Feature Articles for the MTT Newsletter



by John Eisenberg

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

If you know of a topic that is current and/or you are willing to contribute an article to the Newsletter, please contact:

John Eisenberg
25 Parson Way
Los Altos, CA 94022
(415) 941-7426

CAEME: An Exciting Initiative to Apply Computers to Stimulate and Improve Electromagnetics Education



Magdy F. Iskander
Director, CAEME Center
Electrical Engineering Department
University of Utah
Salt Lake City, Utah 84112



Barry S. Perlman
MTT-S AdCom/Education Committee
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Editorial by B. S. Perlman

This article reflects on an exciting opportunity to make a difference in electromagnetics education. A similar discussion has appeared in several other Newsletters, particularly those of the Antennas & Propagation Society. I have taken much of that material in context and included it here to share it with you. Credit with thanks go to two very distinguished and dedicated individuals, Dr. Irene Peden and Dr. Magdy Iskander, with whom I have the pleasure to be associated in this effort and to whom I am indebted for this material. I am pleased to recognize them for their dedication and vision in planning this activity. Magdy sent this information to me and I am pleased that we were able to compile it in this self-contained form.

There is increasing awareness that a trend exists to reduce the curriculum offering in the electromagnetics area. This is particularly alarming as it might affect the availability of qualified microwave engineers. This concern was noted by Professor Irene Peden, University of Washington and Past President of the IEEE AP-Society. In a recent AP-S Newsletter Message (October 1989), Dr. Peden stated:

"that the teaching of electromagnetics has been squeezed down in most undergraduate curricula to less time than is really needed by the students to understand and relate

to it with more than sheer endurance. Students tell us that there is more content to the EM core course than they are used to managing, and they offer this as criticism. Alas, high grades are no guarantee of insight and/or an intuitive grasp of engineering concepts. These students need more conceptual support, and the EM community needs to see a realization of it, if the talent pool is to be maintained at an appropriate level."

An innovative solution has been initiated in the form of the NSF/CAEME project (Computer Applications in Electromagnetics Education). Professor Magdy F. Iskander, University of Utah, has been appointed Director of a \$250,000 NSF grant, recently awarded through the IEEE/AP-S. This effort is intended to accelerate and stimulate the use of computers in electromagnetics education, by using computer-aided design, analysis and simulation software, graphical visualization tools and related computer-assisted educational aids. All areas of computational electromagnetics will be investigated, and curriculum development will be a goal, including new courses and computer-based laboratory experiments. Cooperation between interested universities will be pursued as will cooperation and support from electromagnetics-based societies, inside and outside the IEEE, in addition to industry. The CAEME center activity will be initially funded by the Undergraduate Science, Engineering, and Mathematics Division of the NSF and managed by the Executive Office of the IEEE. The MTT-S AdCom has approved joining in this effort with the AP-S (host society) as has the Applied Computational Electromagnetics Society (ACES). Hewlett-Packard has also decided to be a sponsor with the Naval Research Laboratory, Texas Instruments, and Hughes seriously considering joining in.

The NSF grant will provide three years' funding for the CAEME project. CAEME is interested and involved in all areas of computational electromagnetics, including software for microwave circuit design, computer-generated movies and graphics, numerical techniques and solution procedures, and various aspects of curriculum development. CAEME has already published a first version of a catalog of available software that includes a brief description of its uses, and contacts for additional information and/or for obtaining copies. Seven hundred copies of the catalog were distributed in the MTT-S/AP-S 1990 Symposia in Dallas, and 250 copies were sent to Electrical Engineering Department Heads in United States universities. Its second project will be to publish three books, with chapters contributed by developers of tested and approved software. These books will be distributed free of charge to electrical engineering departments, and in all cases, NEEDHA (National Electrical Engineering Department Head Association) will assist in the distribution of the CAEME products and related information.

To describe CAEME activities, let me start by offering some historical details. The following events are listed in chronological order:

NSF Evaluation of the CAEME Proposal

Shortly after receipt of the NSF grant of \$250,000 for CAEME development, NSF sent out copies of the reviewers' evaluations of the CAEME proposal. A copy of these evaluations is included in Appendix A. Magdy has suggested sharing this information with you to emphasize the timeliness and the well thought-out structure of the CAEME project. All ratings were "excellent" because the work is badly needed, key players were involved, and the project objectives and procedures were well thought out. Congratulations to the AP-Society for a job well done!

Policies and Procedures for the CAEME Center

Before proceeding with CAEME's projects and activities, it was necessary to have the Center's operating policies and procedures in place. Among other things, it is very important to identify key CAEME officers, their responsibilities and term of office, CAEME products and their delivery schedule, and set policies regarding participation by IEEE and non-IEEE societies and sponsorship by companies. A group of individuals representing NSF, the Executive Office of IEEE, and the various participating societies and sponsoring companies met on December 2nd in Salt Lake City to set and approve CAEME policies and procedures. This meeting was attended by Professor Magdy F. Iskander, Center Director; Dr. Edward W. Ernst, Program Director from NSF; Dr. Rudolf A. Stampfl, Director of Educational Activities in IEEE; Dr. Irene C. Peden, President of AP-S (the host society of the CAEME project); Dr. David Chang, Vice President of AP-S; Dr. Craig Rushforth, representing the National Electrical Engineering Department Head Association (NEEDHA); Dr. Jim Logan, representing ACES; Dr. William Pedler, representing Hughes Aircraft; and myself. Dr. Zvonko Fazarinc, who is the designated CAEME representative from Hewlett-Packard, was not able to attend because he was celebrating his 40th wedding anniversary the same weekend. We missed Dr. Fazarinc in this important meeting, and we would like to congratulate him on his anniversary.

A report on the first CAEME Policy Board meeting was prepared. It includes copies of the approved policies and procedures, CAEME organization structure and technical activities, and a list of various CAEME projects and their proposed budget and schedule. You can contact Professor Iskander for more information.

Appendix B-1 shows CAEME's organizational chart, while Appendix B-2 shows its technical activities. A copy of the approved policies and procedures is given in Appendix B-3. It is important to note the availability of seed money to sponsor projects of interest to CAEME, and the operational procedure for applying and obtaining these funds. It may also be of interest to note that the CAEME Center will operate and carry out its projects by establishing several subcommittees and task forces. Examples of these subcommittees include the standards, new projects, publication, finance, and evaluation subcommittees. Many volunteers are needed to work and contribute to these subcommittees. If you want to get involved, just let Magdy know and we will be glad to match your interest with the responsibilities of one of these groups. The success of CAEME depends on commitment by individuals who are willing to help in areas that fit the ongoing teaching and research activities.

Technical Activities

CAEME technical activities include the development of a software catalog, sponsorship of special sessions and workshops in international symposia, and the publication of books that include diskettes of educational software. As the MTT-S representative to the CAEME Policy Board, I would like to solicit your input to discuss these items in more detail. One item under discussion is having a CAEME workshop at IMS-91 in Boston. I believe that this will be very beneficial to MTT-S members and will be suggesting this topic to the 1991 TPC. (See "1990 AP-S Workshop" and "1991 MTT-S Workshop.")

Technical Advisory Committee

A Technical Advisory Committee is being formed to provide an independent input on the educational quality of CAEME's products and directions. It will be asked by NSF and/or by any of the participating societies and industries to provide an evaluation of this activity. This group, chaired by Professor

Robert E. Collin, is at present composed of the following individuals: Dr. Robert Hansen and Professors Y. T. Lo, Roger Harrington, and C. T. Tai. Dr. Edmund K. Miller will be representing ACES on this committee. Several are AP-S Distinguished Award winners and several are members of the National Academy of Engineering. MTT-S is planning to select one of its distinguished members to represent our society to enhance this worthwhile cause.

CAEME Catalog

The first CAEME product is a catalog of available software. A list of approximately 36 software packages covering various aspects of electromagnetic education has been compiled. A first version of this catalog has already been published and if you need a copy, just let Magdy know. If you have a software package or are aware of some that should be listed in the catalog, also let Magdy know as soon as possible. You may call him just to make sure that he is aware of your work and that it has been appropriately included in the catalog. A sample page of the catalog is given in Appendix C for your reference. In sending information regarding your software, please make sure that you include all the required information.

CAEME Workshop at the 1990 AP-S/URSI Symposium in Dallas

A workshop and panel discussion on computer applications in electromagnetics education was held on May 11, 1990, in conjunction with the joint MTT-S/AP-S International Symposium. This workshop was organized by AP-S and held with other AP-S workshops at the Sheraton. This workshop was organized by Magdy F. Iskander (University of Utah), A. T. Adams (Syracuse University), and Irene C. Peden (University of Washington). Unfortunately, this workshop topic was not mentioned in the IMS announcement and therefore most MTT-S members were unaware of this activity. The good news is that both Magdy and myself were there and I can report that it was very successful and well received. Magdy gave a progress report which was followed by presentations covering issues of broad interest to computer applications in electromagnetics education. Topics covered were:

"Standards in Software Development and Documentation," Professor R. F. Harrington (Syracuse University) and Dr. T. Reeder (EEsof)

"Computer Based Microwave Laboratory," Professor T. Healy (Santa Clara University)

"Curriculum Development and Future Needs," Professor C. M. Butler (Clemson University) and Professor L. B. Felsen (Polytechnic University)

"Trends in Computer Architecture Including Interactive Video," Dr. R. Stone (McDonnell Douglas Technologies) and Dr. D. Wilton (University of Houston)

"Introduction to New Software Packages for EM Education," Dr. Z. Fazarinc (Hewlett-Packard), Professor Y. Rahmat-Samii (UCLA), Professor N. N. Rao (University of Illinois), Professor R. Compton (Cornell), Professor R. Cole (UC Davis), and Professor M. Zahn (MIT)

Panel Discussion on "Trends and Future Needs of Computational Tools for Electromagnetics Education," A. T. Adams and M. F. Iskander.

(cont. on page 62)

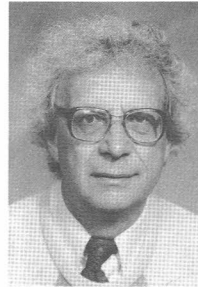
Dr. Ernst Schloemann Receives "Excellence in Technology" Award



On June 12, 1990, Raytheon Company honored 18 engineers and scientists chosen among 27,000 for their technical achievements. The awards for "Excellence in Technology" are the highest distinction the company bestows for technical achievements. The current 18 award winners join the 16 other company scientists and engineers honored when the Excellence in Technology Awards were established in 1988. One of the recipients for 1990 was Dr. Ernst Schloemann, a consulting scientist with the Research Division. Dr. Schloemann has been with Raytheon since 1955 after obtaining a Ph.D. in physics from the University of Göttingen, Germany, and post-doctoral work in solid state physics at MIT. The citation for the award reads:

"Thanks in large part to E. Schloemann, Raytheon can design, develop and manufacture any microwave ferrite device used in radar systems. His work has been fundamental to several of the company's most successful missile systems. His concepts were also used to help develop the giant Pave Paws radars on the East and West Coasts. Pave Paws can 'spot' an object the size of a basketball 1,200 miles away. Its primary function is to give early warning of a submarine-launched ballistic missile attack. His most recent findings on wideband circulators and circulator miniaturization are rapidly being incorporated into microwave circuits being developed at the Missile Systems and Equipment Divisions."

1990 IEEE Fellows Associated With MTT-S



by Martin Schneider

Contratulations to twenty-seven MTT-S members elected as 1990 IEEE Fellows. Their names and Fellow citations follow:

- | | |
|----------------------------------|--|
| Dr. John W. Archer | "For contributions to low-noise millimeter-wave receiver design." |
| Dr. Donald G. Dudley | "For contributions to electromagnetic target identification, and leadership in education and engineering practice." |
| Mr. Morris Engelson | "For contributions to the practice and application of spectrum analysis, and leadership in its test instrumentation." |
| Prof. Harold R. Fetterman | "For contributions in extending optical technologies into the submillimeter and millimeter wave regions." |
| Prof. Anand Gopinath | "For contributions to the analysis of microstrip discontinuities and to the development of microwave integrated circuits." |
| Mr. A. Ray Howland | "For leadership of the development and production of automated microwave instrumentation systems." |
| Prof. Chenming Hu | "For contributions to the understanding of hot-electron effects in MOS devices." |
| Dr. Ho-Chung Huang | "For contributions to the understanding of solid-state devices and the development of GaAs FET power amplifiers for space applications." |
| Dr. Howard R. Jory | "For technical leadership in the development of gyrotrons." |
| Dr. Ismo V. Lindell | "For contributions to electromagnetic theory and for the development of education on electromagnetics in Finland." |
| Dr. Christoph E. Mahle | "For contributions to the theory, development, application, and measurement of transponder nonlinearity modeling for communications satellites." |
| Dr. Nino A. Masnari | "For contributions to educational and research program development in electronic materials processing." |

(cont. on page 67)

1991 IEEE Microwave Theory and Techniques Society Undergraduate Scholarships

- For children of MTT-S members
- Not limited to engineering
- \$1,000-\$2,500 each
- Renewable for 4 years
- Given to meritorious students based on PSAT/SAT test scores, academic record, GPA, class rank, leadership, career goals, significant extracurricular and community activities.
- Application forms for the IEEE Microwave Theory and Techniques Undergraduates Scholarship can be obtained from the Citizens' Scholarship Foundation of America (CSFA).
- Requests for application forms should be made in writing before January 1, 1991, and refer to the MTT-S Undergraduate Scholarship.
- Complete applications must be sent to CSFA and postmarked before February 1, 1991:

Citizens' Scholarship Foundation of America
1505 Riverview Road
P.O. Box 297

St. Peter, Minnesota 56082
Telephone: (507) 931-1682

For further information on the Scholarship, contact:

Dr. Reynold Kagiwada
3117 Malcolm Avenue
Los Angeles, CA 90034
(213) 814-1970

Student and University Participation at the 1991 IEEE MTT-S Symposium



by Prof. Peter Rizzi
Southwestern Massachusetts University
Electrical Engineering Department
North Dartmouth, MA 02747
(508) 999-8479
Fax: (508) 999-8485

For the first time, the IEEE MTT-S Microwave Symposium will include certain activities that are specifically designed to highlight microwave research and development in universities. The activities will consist of a student paper contest and the use of exhibit booths by universities engaged in microwave education and research.

The student paper contest is based upon a proposal presented to AdCom by Prof. Ronald Carter of the University of Texas at Arlington. The contest will be held as part of the Technical Program of the 1991 Symposium. It will be open to both graduate and undergraduate students. The papers will be presented at a special session on Tuesday, June 11th, and will be judged for content, presentation, and visual materials. First, second, and third prizes will be awarded. Both cash prizes and certificates will be presented to the winners. A panel of judges chosen by the 1991 MTT-S Symposium Steering Committee will select the three finalists. In addition to the awards, travel stipends will be available for students whose papers are accepted for presentation at the symposium.

The Steering Committee is also planning to make available several booths in the exhibit hall for the display of information on microwave research in universities. The concept is similar to that used at the European Microwave Conference. The idea is to make both industry people and students aware of the microwave activities and facilities in colleges and universities. The hope, of course, is that this will encourage more interaction between the microwave industry and academia, as well as generate an increased interest in microwaves among engineering students.

Because of limited booth space, only about a dozen schools will be selected to participate this year. About half the space will be assigned to schools within a few hundred miles of the convention site. The plan is that since the symposium site differs from year to year, the schools selected will vary accordingly. Thus over the years, many institutions will have the opportunity to "show their wares." Since this is a first attempt at this sort of thing, there may be some problems along the way. Please bear with us as we try to make these new activities successful.

Any questions regarding the organization of either the student paper contest or the university exhibits may be directed to the author.

Education Committee Report



by Reynold S. Kagiwada

For 1990, three recipients were selected by the Citizen's Scholarship Foundation of America, Inc. (CSFA) for the IEEE-MTT Society Undergraduate Scholarships. They are Ursula A. McVeigh of Hauppauge, New York; Amanda A. Svensson of Issaquak, Washington; and Sarah E. Williams of Bethesda, Maryland. These awards are for one year and renewable for four years.

CSFA made the selection from a number of outstanding applicants. CSFA manages these awards for MTT-S and independently and confidentially collects information about applicants on forms specially prepared for these awards. In making the selections, CSFA utilizes PSAT/SAT scores, class rank, academic records, GPA, leadership, career goals, community and extracurricular activities, and teacher recommendations. The eligibility of the parent in regard to active membership is verified through IEEE headquarters. For the next school year beginning 1991-1992, the announcement for request of information appears in this issue of the MTT-S Newsletter.

Ursula Anne McVeigh will be attending Johns Hopkins University, where she will be majoring in Physics. She has been interested in physical science for some time. In her spare time, she pursues such hobbies as reading, studying astronomy and playing/composing music on the piano. Ursula remarked, "The feeling of elation that I experienced when I read the award letter is hard to adequately describe. Let me assure you that the value of this award to a recipient is not just momentary but is a huge 'pat on the back'."



Amanda (Mandy) A. Svensson enjoys horses and local politics. She rides dressage and belongs to several city committees. Mandy is interested in community service and is an officer in Key Club. She has been accepted at Stanford, Yale, Cornell, and the University of Washington. Mandy plans to major in Electrical Engineering. She hopes to receive three degrees, including a Bachelor's of Engineering, Master's of Engineering, and an M.B.A. Mandy remarked, "I am thrilled to be the recipient of the IEEE Microwave theory and Techniques Society Scholarship. This scholarship will help me finance my education and I appreciate it very much. Thank you again for this great honor."

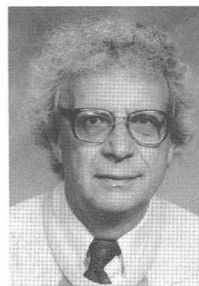


Sarah E. Williams will attend Princeton University. At Princeton, Sarah will be majoring in Biology. Sarah has been very active in athletics for four years. She was a member of the field hockey team at Walter Johnson. This year the school field hockey team won the Maryland state championship. Sarah

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Martin V. Schneider Elected Division IV Director

by Al Estes



Martin V. Schneider

Eric Herz, IEEE Executive Director, announced November 5, 1990, that Martin V. Schneider was elected to the Office of Division Director for Division IV. Martin was and still is a "mover and a shaker" on MTT-AdCom. All of IEEE, not just the Members within our Division, will benefit from Martin's influence on IEEE's Board of Directors. Martin's IEEE Curriculum Vitae follows:

IEEE Curriculum Vitae of Martin V. Schneider

Objective

Develop and implement advanced marketing techniques to improve services to IEEE members and introduce innovative continuing education programs. Become instrumental in helping to transform the IEEE into a dynamic transnational professional organization.

Honors

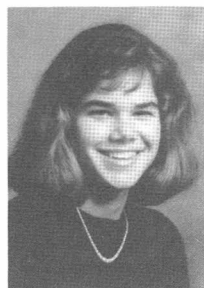
1. IEEE/MTT Meritorious Service Award, 1989, "For the development and implementation of advanced marketing techniques to improve services to IEEE/MTT members and introduction of innovative continuing education programs."
2. IEEE Centennial Medal, 1984, for "Outstanding record on contributions and related publications in the fields of semiconductor devices and thin film circuits at microwave and millimeter-wave frequencies."
3. IEEE Region I Award, 1984, for "Outstanding leadership in conducting short courses and tutorials."
4. Microwave Prize, 1979, for joint paper with Eric R. Carlson and Thomas F. McMaster on "Subharmonically pumped millimeter-wave mixers."
5. IEEE, Fellow Award, 1976, "For contributions to millimeter-wave integrated circuits and devices."

Major Accomplishments

1. Initiated the creation of the first IEEE bilingual and trilingual video tapes (English, French and Spanish) on Emerging Technologies. With the participation of my French colleagues, Olivier Scaramucci and Pierre Encrenaz, the tapes on "Coherent Detection Techniques" and "La Detection Coherente" were completed.
2. Prepared proposal and received approvals for publication of

(cont. on next page)

Education Committee Report (cont. from previous page)



says, "I was delighted to be awarded the MTT-S scholarship and would like to thank the Microwave Theory and Techniques Society for sponsoring the education scholarship." Sarah is the sister of David J. Williams who was one of last year's recipients for MTT-S Undergraduate Scholarship.

There were several awards renewed. For 1989 CSFA there were Sandeep K. Agarwal, Karen A. Erlandson, Fredrik L. Rehnmark and David J. Williams. For

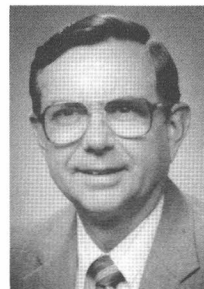
1988 CSFA there were Lena Gandhi and Harlan Howe III.

The 1990 Graduate Fellowships of \$5,000 each were awarded to four recipients: Kiziloglu Kursad of the University of California at Santa Barbara, Robert A. York of Cornell University, Nitin Jain of Rensselaer Polytechnic Institute and Cynthia M. Furse of the University of Utah.

This year's Grant-in-Aid was awarded to Prof. David R. Voltmer of Rose-Hulman Institute of Technology and Prof. James J. Whalen of State University of New York at Buffalo. For the 1991 Graduate Fellowships and Grants-in-Aid, an announcement is appearing in this issue. Dr. Jorg Raue has again done an outstanding job in managing these activities in his usual very efficient manner.

The MTT-S Education Committee is soliciting applications for a Student Paper Contest for the 1991 IEEE MTT-S International Microwave Symposium. Professor Ronald L. Carter of the University of Texas at Arlington is coordinating these activities. He will greatly appreciate your ideas and help. His phone numbers are: (707) 577-5295 (office) and (707) 577-5260 (fax).

MTT-S Bylaws Changes



by Jim Wiltse

At the September 1989 meeting, AdCom voted to change the status of the International Liaison Committee from a subcommittee of the Membership Services Committee to a separate standing committee, as well as changing the name of the committee to the Transnational Committee.

At the May 1990 AdCom meeting, a motion was approved unanimously to formally modify the Bylaws as shown above. IEEE Headquarters has been notified of the change and 30 days after this notification in the Newsletter, the Bylaws change will officially take effect.

*Martin V. Schneider Elected Director
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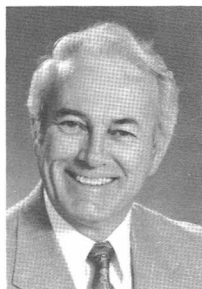
new Letters Journal entitled "Microwave and Guided Wave Letters," with Tatsuo Itoh as Editor-in-Chief.

3. Substantial growth in MTT-S membership and number of Chapters during the tenure as MTT Membership Services Chairperson (3-year term from January 1986 to December 1988).
 - a. Membership increase from 8,715 to 11,750 members (35%).
 - b. MTT Chapter increase from 46 to 62 (35%) worldwide.
4. Introduction of video tape program with an initial offering of six 50 minute tapes of MTT Distinguished Lectures and selected topics from the Speakers' Bureau Program.
5. Implementation of the Speakers' Bureau Program originally proposed by Reinhard Knerr and the MTT-S Long Range Planning Committee in January 1988 (10 topics and speakers on "Emerging Technologies").
6. Proposed and received AdCom approval for the first overseas Distinguished Lecturer ("Computer Aided Design of Hybrid and Monolithic Microwave and Millimeter-Wave MICs" by Rolf H. Jansen, West Germany).
7. Initiated the foundation of new domestic and overseas MTT Chapters (New Jersey Coast, Ithaca, Switzerland, West Germany, Scandinavia, Australia and Yugoslavia).
8. Accomplished affirmative action objectives by encouraging women to participate actively at MTT-S committee levels.
9. Promotion of increased attendance of MTT and IEEE members at International Microwave Symposia, Mini-Symposia on the East Coast and in Western Europe, and organization of tri-chapter meetings in the tri-state area (New Jersey, New York and Pennsylvania).

Offices Held: IEEE & MTT

- 1990: Member IEEE Fellow Committee
- 1989/90: Chairperson MTT-S Publications Committee
- 1986/88: Chairperson MTT-S Membership Services
- 1985: Organizer and Director of NATO Summer School on "Solid-State Devices in Communications," July 15-27, Erice, Italy (co-sponsored by IEEE and MTT-S)
- 1984/85: Chairperson MTT-S Publications and Standards Activities
- 1982/83: Chairperson, Joint Group Chapter on Microwave Theory and Techniques, Electron Devices and Quantum Electronics and Applications, New Jersey Coast Section IEEE
- 1981/82: Secretary/Treasurer, Joint Group Chapter ED, MTT & QEA, New Jersey Coast Section IEEE
- 1979/81: Nominations Chairperson, New Jersey Coast Section IEEE
- 1979/80: Member, IEEE Awards Planning and Policy Committee
- 1978/79: Awards Chairperson, N.J. Coast Section IEEE
- 1978/83: Member, Technical Program Committee, IEEE International Microwave Symposia

Division IV Director's Report



B. Leonard Carlson

Since the beginning of the year, I have been assigned to several Ad Hoc and standing committees. This report is intended to give you an overview of what is happening as it pertains to society activities.

ADVOSC — Volunteer Restructuring Committee

Although not a very popular subject, nonetheless, this committee was chartered to look at the volunteer structure and determine if changes could be made which will enhance our transnational commitments and responsibilities. The comments, as a result of the preliminary report submitted to the BOD in July of 1989, have now been incorporated in the report. In addition, meetings have been held with the Educational Activities Board and Standards Board to better understand their concerns and comments. As of this date, the committee has completed its study and a final report is being presented to the BOD at the August meeting in Denver. Any decision on accepting or rejecting will be postponed until the November meeting in San Diego. In the meantime, each society will receive copies of the report and TAB will have the chance to vote in November, unless the August BOD refuses to accept the report; in which case, it becomes history. I might add that the ADVOSC committee spent a lot of time going over all the comments and concerns. The background and rationale for the recommendations is included in the report.

RAB/TAB Chapters Committee

The RAB/TAB chapters committee is new and the charter has been approved by both RAB and TAB, with bylaws to be approved at the August BOD. The central issue being dealt with is how can TAB/RAB better support the chapters. RAB has agreed to have a regional chapter coordinator who will oversee the professional aspects of chapters much the same as a society chapter's coordinator now worries the technical issues of the chapter. The big show for chapters this year is the Sections Congress 90 being held in Toronto. During the February TAB meeting, it was decided that \$1,000 be given to each society to be passed on to most deserving chapters for use in sending a representative to SC90. This is in addition to the societies sending their own chapters coordinators. A Chapters Interest Survey for SC90 has been prepared and will be handed out and conducted in Toronto. I will be organizing a session for society chapter coordinators, tentatively scheduled for Thursday, October 4, 1990.

Video Training Committee

This ad-hoc committee is chartered to prepare video training material for societies and chapters. Currently, a video training script has been prepared and taping is being done at

the North Carolina State Video Studios in Raleigh, NC. The title of the first tape is "Society Leadership" — An Introduction: "Your Society and TAB," approximately 15 minutes, the second tape entitled "Society Organization and Governance," also 15 to 20 minutes. The script is in approval routing. The third tape planned for this year is "Society Finances" and the outline is being finalized and a preliminary script being written.

Transnational Committee

The Transnational Committee is comprised of both RAB and TAB directors and essentially the charter is to help enhance the transnational aspects of the IEEE. There are currently 4 task forces: (1) The first is establishment of IEEE office outside the U.S., this is currently underway with space being provided by the Computer Society in Brussels, Belgium, (2) the second is task force on establishing IEEE relationships with non-IEEE entities, (3) the third is task force on value added aspects, and (4) the fourth is international participation. All the above task forces have some impact on societies since societies are, by nature of their existence, transnational.

Educational Activity Board

As the TAB representative, I attended the EAB meeting in Vienna, Austria, on July 1, 1990. The meeting was held in conjunction with the FIE symposium being held 2-5 July 1990.

Audit Committee

I'm also a member of the IEEE audit committee which has met 2 times this year and one of the issues that keeps coming up is G&A (General and Administrative) costs and how should they be recovered. The end result is that the Finance Committee at its meeting on G&A in July received a report that 1990 General Fund would have a \$2.5M deficit. The committee discussed the possibility of a general dues increase and a G&A percentage of 3.5% to be assessed for services rendered (this was not accepted). The committee discussed various possibilities, following is a list: (1) Across the board percentage cuts, (2) program reviews by staff, (3) increase dues (\$10 generates \$2.0M), (4) allocation of G&A, (5) increased service rates, (6) conference surcharges, and (7) new income sharing. Following proposal was recommended for forwarding to Budget Development Committee and BOD.

- (a) \$2.00 dues increase for student member
- (b) \$6.00 dues increase for members
- (c) Reduce the deficit by \$1.0M, a 2% reduction in spending
- (d) Ask the TAB Long Range Finance Committee to recommend a G&A mechanism to IEEE Finance Committee for implementation in 1991.

The bottom line is that a G&A cost will somehow be added to services provided to Societies by the IEEE.

Issues related to TAB are covered by the President's report, and thus, I will not cover herein.

Highlights From TAB Meetings

Contributor: Irving Engelson, TAB Secretary

The following actions were taken by the Technical Activities Board at its June 29, 1990, meeting:

IEEE Microwave and Guided Wave Letters

TAB endorsed the IEEE Microwave Theory and Techniques Society's proposal to publish a journal to be called *IEEE Microwave and Guided Wave Letters*. The journal will include theoretical and applications oriented papers, with a turn-around time of less than three months.

IEEE Transactions on Circuits and Systems for Video Technology

TAB endorsed the IEEE Circuits and Systems Society's proposal for a journal to be called *IEEE Transactions on Circuits and Systems for Video Technology*. The scope of this new publication is not intended to include consumer electronics applications of video such as HDTV and ATV.

Society Access to TIP Information

TAB passed a motion to allow Society/Council Presidents to gain access to the Technical Interest Profile of its members, for internal Society analysis under the control of the Society President. Since TIP information is considered part of a member's personal record and is treated in a restricted manner, privacy concerns will be addressed in implementing this motion.

TAB Position on G&A

TAB discussed the Institute's proposal to introduce G&A charges. TAB recognized the financial problem identified by the IEEE Ad Hoc G&A Committee, but felt that its proposal is an incomplete response to the problem. TAB, therefore, passed a motion recommending that the IEEE Board of Directors expand the role of the committee to allow it to analyze both expenditures and sources of income. The motion also created a TAB Long Range Ad Hoc Financing Committee, composed of the former TAB G&A Committee and others to be appointed by the TAB Chairman, which will consider alternatives for ameliorating the IEEE financial problem and present a report at the next TAB meeting.

Contract Policy

TAB recommended that the IEEE Board of Directors adopt a policy that no contract or agreement which conveys exclusive rights binding on other IEEE entities be written without prior notice to the IEEE Executive Committee.

1992 Publishing Services Rates

The TAB Periodicals Council is assisting the Publishing Services staff in establishing realistic rates for 1992. TAB endorsed a set of basic principles to be applied in restructuring those rates for 1992 and subsequent years. Among them are: the rate structure should be simple, understandable and easily translated into budgets and accounting statements; rates should be disaggregated so that Societies/Councils pay only for services used; cross subsidies between classes of periodicals should be phased out; rates should be competitive with market

prices for comparable services available from non-IEEE providers; Societies/Councils should be allowed to purchase services from non-IEEE providers where there is a significant long-run economic advantage.

Lasers and Electro-Optics Society Field of Interest

TAB endorsed the addition of the word "materials" to the Society Field of Interest.

TAB Office in Region 8

A motion was passed authorizing an expenditure of not more than 6,000,000 Belgian francs to establish a TAB presence in Brussels, Belgium through expansion of the existing Computer Society operation.

New Ventures Workshop

TAB authorized an expenditure of up to \$10k for the New Ventures Ad Hoc Committee to conduct a workshop in conjunction with the February 1991 TAB meeting on "Electronic Member Technical Information Delivery Services." The aim of the workshop is to identify customers and their needs, determine the types of competition, and review the current state of the art.

The Learning Channel

TAB passed a motion recommending that the contract between IEEE and The Learning Channel be terminated, in view of the lack of progress in renegotiation.

Volunteer Restructuring

TAB recommended that the BOD take no action on the report of the Volunteer Restructuring Committee until it is reviewed by TAB and other IEEE entities.

1991 Colloquium in Europe

TAB voted to appoint a Committee to plan for a 1991 Colloquium with a focus to include Eastern Europe and a TAB budget not to exceed \$150k.

University-Industry Relations

TAB agreed to co-sponsor the EAB Ad Hoc University-Industry Relations Committee since its scope relates closely to the activities of many Technical Societies and Councils.

TAB-Standards Interaction

TAB voted to form a joint Ad Hoc Committee with the Standards Board to promote global Standards development. The Committee will seek to improve cooperation between TAB and the Standards Board.

CD-ROM

TAB supports worldwide distribution of IEEE publications through use of CD-ROM as well as other traditional media. TAB is developing a plan with IEEE and UMI.

Dues Payments

In anticipation of a TAB presence in Brussels, Belgium, and growing international membership, TAB recommends that Region 8 members be able to use local currencies for the payment of dues and fees without incurring additional processing costs.

Membership Development in Regions 8, 9 and 10

To foster membership growth in Regions 8, 9 and 10, TAB recommends that Societies sponsor a limited number of memberships in these Regions.

TAB Highlights



by Tatsuo Itoh, President

First TAB Meeting

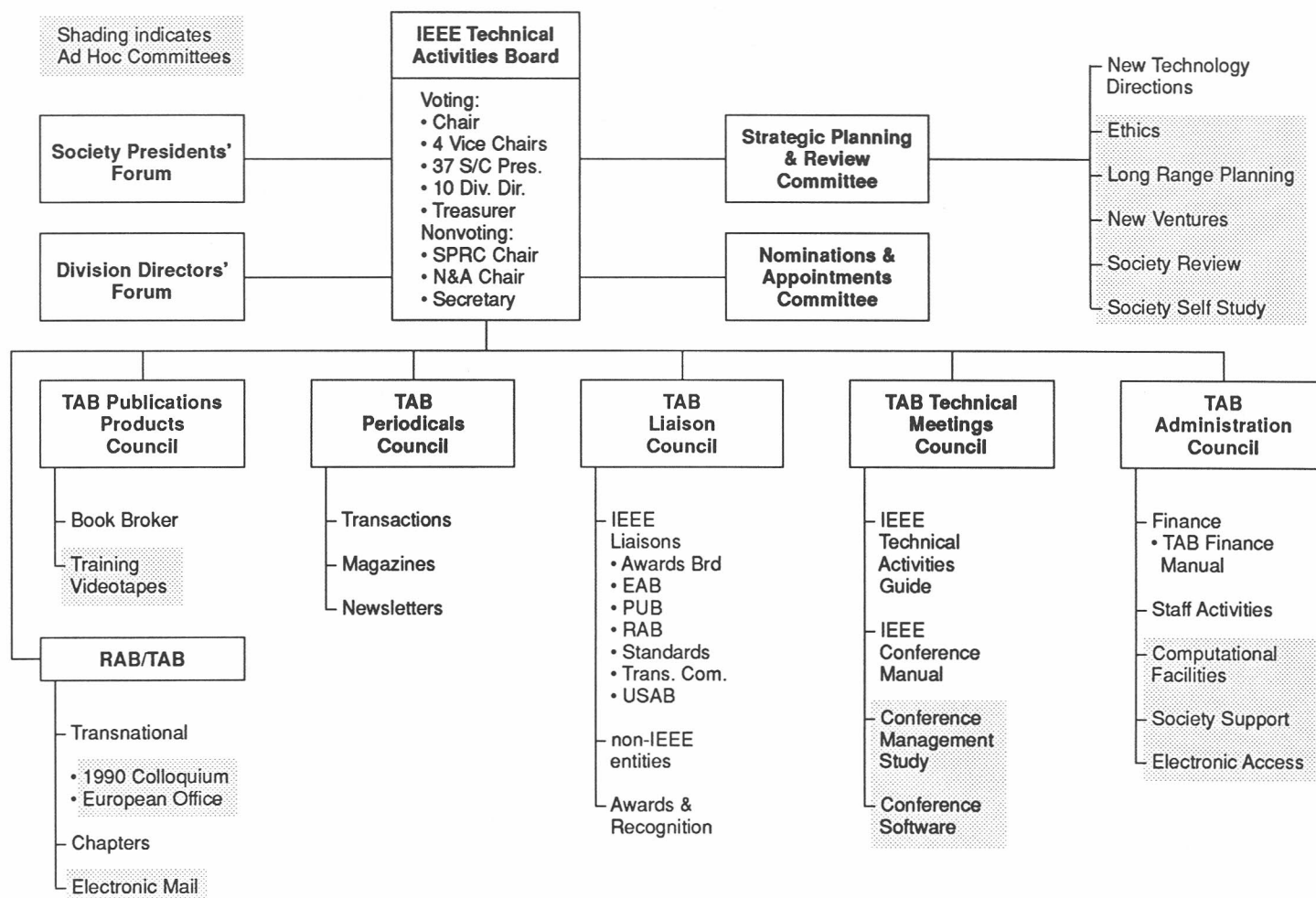
The first TAB (Technical Activities Board) meeting for 1990 was held in the Adam's Mark Hotel in Charlotte, North Carolina on February 20. Prior to the formal meeting, the TAB Caucus was held on the afternoon of February 19, and was attended by Division Directors, Society Presidents and other TAB committees to discuss various issues related to TAB activities. Possible action items for the formal meetings were discussed and debated. In the evening, a Society Presidents' Forum was held. This forum was intended to generate response from the Society Presidents on various issues discussed during the Caucus. This format of informal meetings was instituted last year so that the participants could digest many

complex issues in order to expedite business at the formal TAB meeting.

The formal meeting was still very packed and busy. A number of motions were introduced, as well as many reports and information items. In the area of publications, the computerized desktop publication of the IEEE Transactions is in progress. The Computer Society has started this process and other society transactions will follow during the next several years. This process is expected to save about \$40 per transaction page. A publication workshop will be held on the subject of electronic publication in June 1990. In connection with publication activities, a motion was introduced and passed which states that the rule be clarified for appointment to the Transactions, Magazines and Newsletter Committees under the TAB Periodicals Council to allow the Society President to appoint Society representatives. This is in response to several societies which publish more than one Transactions. IEEE strongly encourages that all major publications be mailed in a suitable biodegradable wrapper to ensure delivery on time and in good condition. Each society can make its own decision as to this matter.

In the area of transnational activities, TAB endorsed a proposal from the TAB Transnational Committee (TC) to establish its European Office in Brussels. This mechanism is to take advantage of the European Office of the Computer Society for cost effective operations. The TC also encouraged every society to establish sponsorship, co-sponsorship and active participation in conferences and technical meetings

TAB Corporate Organization



outside Regions 1-6 (U.S.). In addition, TAB approved the TC recommendation to encourage non-U.S. participation in IEEE administrative activities. TAB also approved the TC motion to modify the dues for low income members that, starting with the 1991 dues billing, the minimum income level below which dues reduction is accepted will be 100 times the basic IEEE dues. TC reported their plan for implementing the 1991 Colloquium possibly taking place in Eastern Europe.

TC outlined the plan for the 1990 Colloquium in Region 9 taking place from September 1-15, 1990, for which TAB endorsed a fund for up to \$40K. Another motion was approved which provides up to \$1000 to each society to send a representative to the Section Congress taking place in Toronto, Canada, on October 5-7, 1990.

The ad hoc committee report on IEEE Volunteer Restructuring was presented. This is distinct from the TAB reorganization which was being implemented. (See the article by K. Tomiyasu on the TAB reorganization elsewhere.) This Volunteer Restructuring move has drawn a considerable amount of attention from a large cross section of IEEE members both domestic and abroad, and many society presidents including myself have been and still are expressing a major concern. The report contained several elements. In the area of standard activities, the report indicated good support from societies and good activities on new standards have been practiced. However, the committee expressed a concern over uneven distribution of national advocates. A more controversial issue was a proposed removal of ABET activities from the EAB (Education Activities Board) and placement under the USAB (U.S. Activities Board) under the notion that the EAB is internationally oriented while the ABET is a national activity. Several questions were addressed by a number of presidents that this is not a completely convincing argument. The formation of IEEE-* (area specific entity such as IEEE-USA) was a much more debatable issue. The committee appeared to have been slowed down in its process toward Restructuring. However, this remains a major concern to many IEEE members.

Since TAB is a complex organization but is vital to the technical health of the IEEE and to MTT-S, a somewhat more visible understanding is needed. For this reason, a corporate chart is included with this report.

Second Tab Meeting

The second Technical Activities Board (TAB) meeting of the IEEE this year was held at the Four Seasons Olympia Hotel in Seattle, Washington, on June 29. Following the recent tradition, this official TAB meeting was preceded by a number of meetings. TAB Caucus was held on the evening of June 27 where a number of subjects of interest to the TAB were introduced for preliminary studies and discussions. The morning of June 28 was devoted to the Presidents' Workshop. A general session was scheduled to be followed by several breakout sessions. However, after the general session, the entire body of the Society Presidents decided to remain in one room to discuss the G&A (General and Administrative) issue. This issue is related to the IEEE fiscal restructuring in recognition of the steadily decreasing IEEE General Fund. There were many causes for this decline, one of which is the past history of not increasing the general dues which was held at a level far below the inflation rate. In response to the Ad Hoc Committee created by the Board of Directors, TAB has already created an Ad Hoc Committee to study alternatives. The original plan was to impose about 7% of charges to Society's expense. Obviously, a number of strong objections to this concept have been voiced.

Subsequent to this G&A session, the Presidents had selected one of four breakout sessions. I attended the one on

Eastern European Initiative, 1991 Colloquium and Membership in non-U.S. regions. My choice was based on the fact that the MTT-S is one of the leading societies actively involved with membership assistance and chapter activities in this part of the world. Other breakout sessions were on Book Broker Program, New Publication Products and Volunteer Restructuring.

Based on the studies and discussions during the Workshop, all the issues were further debated at the Society Presidents' Forum in the afternoon. Several motions were worked out and drafted during the Forum. Some of the more important ones are described here.

The official TAB meeting started with the formal approval of the IEEE Microwave and Guided Wave Letters by the TAB. As you know, this is the proposal for a new letters journal submitted by the MTT-S. The new letters journal is not officially approved. After reports from Chairman and Treasurer, several motions worked out during the Presidents' Forum were introduced. A motion was passed that a society shall be provided with TIP (Technical Interest Profile) data about each of its members as part of the data on membership diskettes.

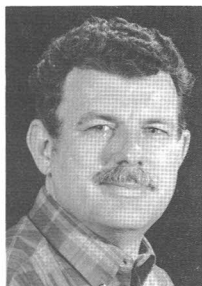
Next, one of the most heatedly discussed items of G&A (as described above) has been debated on the floor and the following motion was introduced and passed. The TAB recommends that the IEEE Board of Directors' Ad Hoc G&A Committee be expanded to analyze both expenditures and sources of income. It is further resolved that the Long Range Financing Committee built upon the former TAB Alternatives Committee be created.

A motion in connection with transnational activities was introduced which reflects the discussions held during the Presidents' Forum. The TAB will appoint a committee to prepare a plan and report back at the November 1990 TAB meeting for an event and additional initiatives for 1991 to be held in Region 8. Included in the items to be studied are: a total IEEE TAB expenditure of not to exceed \$150K, focus to include Eastern Europe, and additional activities such as chapter workshops, joint meetings with national societies, governments and industry, distinguished lecture tours, editorial assistance, fax access to reprints, non-U.S. access to conference proceedings and video lectures. The floor was very supportive of these transnational activities but many present were concerned with cost effectiveness. This concern introduced a budgetary limit of \$150K. Another transnational aspect is the approval of \$200K to establish a TAB office in Brussels through expansion of the existing Computer Society operation there.

A program for societies to assist in the retirement of an Institute loan was announced. The Institute is currently making monthly payments at a rate of 9.6% for the loan made because of the expansion and move to Piscataway. Under the proposed program, Societies can invest in a special fund that will be used to pay off the loan and the Institute payments could be made to the new fund the same as is now being done to the loaning organization. This means that the Society can earn 9.6% of return invested into this fund. The MTT-S treasurer was immediately notified to take advantage of this opportunity.

The next TAB meeting is scheduled in mid-November in San Diego.

35th ARFTG Conference Highlights



by John T. Barr, IV

The 35th Conference was held in conjunction with the MTT-S Symposium in Dallas, Texas. The ARFTG Conference was held at the Fairmont Hotel. Bill Pastori (Maury Microwave), Conference and Exhibits Chairman, reported at the post-conference meeting that there were 86 registrants. There was some discussion as to the low attendance. Although attendance was down in general at this MTT-S Conference, ARFTG was still competing with the MTT workshops.

Suggestions were made during the post-con meeting on improving the attendance. Earlier submission of papers, publication of abstracts and publication of a conference brochure were some of the ideas presented.

Although there was concern over attendance, Bill Pastori reported that income from the Conference is estimated to be \$19,000 and expenses approximately \$17,000. The Fort Lauderdale Conference had very near the same figures with a surplus of \$1800.

Best Paper

Jim Rautio of Sonnet Software was the recipient of the best paper award. His paper, "Experimental Validation of Microwave Software," was selected by the attendees.

Standards Committee

The 7mm comparison kit has been measured by eight laboratories. Two more remain to measure the kit, after which it will be returned to NIST for verification. It will be then sent to England for measurement by the only foreign lab.

The 3.5mm and K connector kits should be ready within two months. There are software changes that have to be made to extend the frequency range of the K kit. The offset shorts for the 3.5mm kit were not included when received. The N kit does not contain the airlines. Maury Microwave will furnish the offset shorts and the airlines. Bob Judish expects all comparison kits to be ready by the end of the year.

Anyone who would like to participate in the ARFTG Measurement Comparison Program should contact Bob Judish at (303) 497-3380. It's a chance to see if you are in step with the rest of the community.

Exhibits Committee

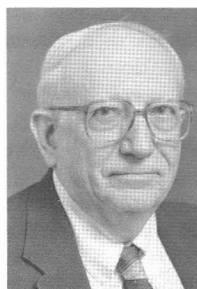
Bill Pastori reported that we lost some old regulars, exhibitors, for this conference but also picked up four new ones. There were ten spaces sold and the income is expected to exceed expenses.

MTT-S Coordinator

John Barr (HP), MTT-S Coordinator, reported that the MTT-S AdCom would like to require conference surpluses

(cont. on next page)

Report of the TAB Periodicals Council/ Technical Publications Board Meetings



Chester L. Smith
Division IV Representative
The MITRE Corporation
Bedford, MA 01730-0208
(617) 271-7086

The IEEE Periodicals Council and the Technical Publications (TechPubs) Board meetings were held on Thursday and Friday, 3, 4 May 1990, respectively. There were several other council (e.g., Finance) meetings on the same day and the second day serves to sum up the several groups and keep them more or less herded in the same direction.

3 May 1990 — The Periodicals Council

The Periodicals Council is still trying to define itself and is working on some proposed changes in the IEEE Bylaws to specify its role in the reorganized staff and volunteer arrangements. Some of the issues are legal, but mostly the discussions centered on ways and means of improving the internal relations among the various TAB and Publications committees, councils and other functionaries. TechPubs would like to encourage more use of E-Mail and the telephone as compared to written correspondence. The idea being that this shift will reduce the amount of paper being processed. The Council will continue the task of monitoring IEEE Transactions, Magazines and other technical products for Timeliness, Appearance and Technical Content. It also has cognizance, for the first time, over Newsletters and Conference/Symposia Records. Last year's bugbear, namely, Conference Records appearing as Transactions Issues, was taken out of TechPubs hands by the Technical Activities Board (TAB) last fall. The policy as it now stands is that Conference/Symposia Records *en toto* will NOT be issued as Transactions. However, a few meritorious papers appearing in A Record, may be further peer reviewed and then published in the Transactions. There is/was no intention that all the papers in a Conference Record be subjected to the more rigorous review expected of a Transaction paper. If there is still some confusion about this policy, place a call to Technical Publishing in Piscataway (or me) and we will do our best to explain what is going on.

Transactions, Technical letters and Journals will be handled as usual by the Editorial Staff, but the Magazines will be a separate activity. All of this is ergodic internal motion and will not greatly affect the outside world. Someone — Irv Engleson, I believe — wondered out loud if the volunteers were getting their "money's worth" from the paid staff. I think, in the main, that they are, but as in the case of any large organization with the multiple interests and complexity of IEEE, it may not seem like it at times.

Someone at the Council Meeting, evidently closer to the cash register than me, observed that the "IEEE Accounting

(cont. on next page)

TAB Periodicals (cont. from page 33)

Department needs to regard the Publications Staff and the Volunteers as their clients instead of the IRS." He also referred to their cost accounting system for Magazines, Transactions and Letters as "Byzantine" and proposed a general overhaul to bring costs down to the point where IEEE's internal publishing costs are at a level below outside publishing services. He also complained that Publishing Services has got to be "easier to do business with." All in all it was quite a dissertation.

New Publications by the Societies

"The IEEE Journal on Superconductivity" was returned by Legal suggesting that the title be changed to "The IEEE Transactions on Superconductivity." The original title was close enough to a certain commercial publication to raise the spectre of infringement.

Circuits and Systems (S-04) has proposed a new publication on "Video Technology and Image Processing" (HDTV?). This was referred to a member of the Council for review and for a recommendation to be presented at the next meeting.

Joint Publication

For the past three years, IEEE and The Minerals, Metals and Materials Society (Warrendale, PA 15086) have been jointly publishing "The Journal of Electronic Materials." The original arrangement called for a review at the end of the third year on whether or not to continue. Ronald Geiger and I were asked to review the journal and make a recommendation. I have looked over all issues for the past three years. In my view it is a high quality technical publication and I see no reason for not continuing.

4 May 1990 — IEEE Technical Publications Board Meeting

David Staiger has retired and a search is on for his replacement as Director of Technical Services. Dave did a good job and he was quite knowledgeable on a variety of things, notably the weird twists and turns of the IRS *vis-a-vis* the U.S. Postal Service. A simple (seeming) question to Dave would merit a lengthy discussion on the whole business including an excursion or two into the whichness of what or the whyhness of wherefore. We wish him well.

Much of the TechPubs Board's business consists of hearing reports and taking any appropriate action. A couple of the more interesting highlights, however, were:

Costs

This is a general review of all publishing costs. Pending the results of this review all charges will remain at the 1989 level through 1990. 1991 costs will be moving in some ways that seem obscure at this time. There are some one-time costs associated with the transfer of Publishing Services to Piscataway. There is no plan to pass these on. Electronic Publishing, if it works the way they think it will, should reduce costs in some areas. Magazines, at this time, are not self-supporting, but are being subsidized from the General Fund. Once set up in Piscataway, Magazines should be self-supporting. There are several tides running in a number of directions and it is hard to say at this time exactly how things will fall out for 1991.

CD-ROMs

There is a plan afoot to launch a pilot CD-ROM marketing effort for the All-Transactions Package (ATP). The CD-ROMs

will be offered to industry, libraries and universities at a cost of about \$25-\$30K. It would include Transactions, Magazines, Technical Letters, Journals, Spectrum The Proceedings and Conference/Symposia Records. New subscribers would receive the back issues for the previous three years as well as the current material. Paper publications will continue in any case.

Copyright Form

A new IEEE Copyright form is on its way. The Legal people seem happier with this one. It should be in the hands of the Editors and Societies by this time; if not, then soon.

Next Meeting Dates

As of this writing, the next meetings of the Periodicals Council and the Technical Publications Board are set for the 24th and 25th (Mon/Tues) of September 1990, at the IEEE offices at Piscataway, NJ 088-1331.

ARFTG (cont. from page 33)

from both MMIC and ARFTG. A discussion by the ARFTG Executive Committee followed. It centered on whether or not we should consider our relationship with MTT-S. They would like to expand their symposium. This expansion would affect the structure of the ARFTG Conference. John Barr remarked that perhaps we should review the possibility of a one day summer conference. No decision was reached.

Conference Planning

36th Conference, November 29th & 30th, 1990

John Barr of Hewlett Packard is the chairman for this West Coast session. The Conference will be held in Monterey, California. The host hotel is the Monterey Sheraton. The theme is:

"On-Wafer Testing II"

The Technical Program Chairman is Gary Roberts of Hewlett Packard. All abstracts should be sent to him. He can be reached at (707) 577-4724.

37th Conference

Date: June 13th & 14th, 1991

Location: Boston, Mass.

Theme: Validation of Design Through Measurements

Chairperson: Bob Judish, NIST, (303) 497-3380

38th Conference

Location: San Diego, California

Chairperson: Al Rosenzweig

Recently Announced IEEE, IEEE-USA Positions on Engineering Career and Technology Policy Issues

by Pender M. McCarter
Manager, IEEE Public Relations

On August 13, the United States Activities component of The Institute of Electrical and Electronics Engineers, Inc. (IEEE-USA) adopted several positions on engineering career and technology policy-related issues (available on request to IEEE Public Relations in Washington, DC) including:

- Developing alternate energy, solar cell technology
- Implementing comprehensive, national computer crime legislation
- Gauging health effects of exposure to microwaves and other radio-frequency electric and magnetic fields, including use of video display terminals
- Enhancing engineering education in the United States
- Adopting professional practices for engineers, scientists, and their employers
- Supporting U.S. technological and engineering employment.

In addition, on August 18, the IEEE Board of Directors adopted a simplified Code of Ethics that sets standards for members' professional conduct.

IEEE-USA Urges Broad-Based Alternate Energy Development Strategy for Government and Industry

Development of solar (or photovoltaic) cells used to convert solar radiation directly into electricity — likely to last as long as 30 years — should receive broad-based support from government and industry, according to IEEE-USA in an August 13 statement.

IEEE-USA says photovoltaics is an attractive source of alternate, renewable energy because, at least in the short term, it is technically, economically, and environmentally desirable. In addition to using photovoltaics for electrical generation during peak load periods, there are applications in water pumping, refrigeration, lighting, corrosion control, and communications equipment, the organization noted.

In its recent statement, IEEE-USA called on federal and state governments, as well as industry and consumers: (1) to increase support for research and development in photovoltaics with the goal of large-scale deployment; and (2) to support an active program increasing public awareness of alternate energy options, including photovoltaics.

IEEE-USA Endorses Comprehensive, National Computer Crime Legislation

Current federal legislation addressing computer crime appears to exclude "assaults" committed over private or locally-operated networks, is incomplete in providing for collection of monetary damages, and is (in some cases) based on "incomplete or ambiguous definitions," according to IEEE-USA in an August 13 statement. The organization called for comprehensive, new national legislation that would:

- Distinguish "deliberately malicious acts" from accidents

- Avoid "overly specific and burdensome" operating requirements on computer systems operators, manufacturers, and users
- Cover a broad range of computer crimes and techniques, without being "tool specific"
- Recognize "trespass" within an information system as a criminal act "without requiring that the system operator or owner demonstrate that there has been further damage or potential to do damage"
- Avoid discouraging research on technology of "malicious codes."

IEEE-USA Indicates "No Cause for Alarm Regarding Environmental Levels of Radio-Frequency Electric and Magnetic Waves"

"There is no cause for alarm regarding the environmental levels of radio-frequency electric and magnetic fields to which the general population is exposed" in various forms, according to IEEE-USA. Radio-frequency electric and magnetic fields are generated by radio and television broadcasting equipment, communications devices, navigation and radar equipment, as well as consumer appliances.

On August 13, IEEE-USA stated: "Based on present knowledge, prolonged exposure at or below the permissible levels recommended by the American National Standards Institute (ANSI) is not likely to be hazardous to human health." The organization concluded: "Research on the biological effects of radio-frequency electric and magnetic fields is . . . needed to ensure that . . . [ANSI] guidelines or any revisions thereof will continue to be soundly based on scientific data."

IEEE-USA Sees "No Convincing Evidence That Video Display Terminal Electric and Magnetic Fields Significantly Influence the Health of VDT Operators or Adversely Affect . . . Pregnant Women"

"At the present time, there is no convincing evidence that video display terminal (VDT) electric and magnetic fields significantly influence the health of VDT operators or adversely affect reproductive outcomes among pregnant women," according to IEEE-USA in an August 13 statement.

However, the organization adds: "Further research is needed before a more conclusive statement can be made regarding the possible reproductive effects of factors associated with extensive use of VDTs." IEEE-USA recommends that future studies address measurements of all the electric and magnetic fields encountered at VDT users' locations.

IEEE-USA, IEEE Educational Activities Outline Objectives for Education, Training of Engineers

According to IEEE-USA and IEEE Educational Activities, in a joint statement issued August 13, preparation of engineers, technologists, and technicians should consider such factors as: practice and design, career-long learning, practice-oriented graduate programs, hands-on laboratory studies, future career paths, the global environment, teaching practicums, and changing demographics.

The IEEE entities elaborated: "Principles of engineering design leading to the manufacturing and fabrication process, should be given a more central role in undergraduate programs."

In addition, the two groups noted that engineering students should "have an opportunity to understand the multiple cultures of the world, especially those of nations creating technological advances."

And they concluded that "participation of members of . . . under-represented groups . . . [such as] women, minorities, and the disabled should be strengthened throughout engineering."

IEEE-USA Describes Professional Practices to "Increase Nation's Productivity and Enhance Opportunities for Engineers, Scientists"

On August 13, IEEE-USA released listings of employer and engineer and scientist practices which the group says "will increase the nation's productivity and enhance the opportunities for engineers and scientists to practice a full, rewarding career."

Included among the *practices for employers* are: adopting stable employment practices, planning and implementing policies for continuing personal and professional growth, providing internal mobility and promotion, as well as improving the performance appraisal process.

Included among the *practices for engineers and scientists* are: taking responsibility, improving value, participating in team-building, emphasizing communications, and completing professional registration requirements.

IEEE-USA Calls on U.S. Congress, Bush Administration to Support "Full Employment" of Engineering Resources

"We call on the U.S. Congress and the [Bush] Administration to implement programs and policies leading to full employment of our U.S. engineering manpower resource," IEEE-USA stated on August 13. The organization supports retraining of defense-oriented engineers to meet civilian needs as well as providing employer and educational institution incentives for such efforts. IEEE-USA urged that long-range efforts be undertaken including: selective capital gains tax reductions, improved technology investment tax credits, and anti-trust safe harbors.

IEEE Board of Directors Approves Simplified Code of Ethics

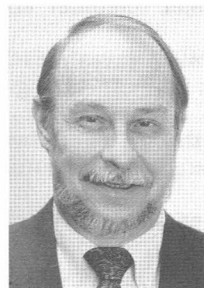
After evaluating member comments, on August 18, the IEEE Board of Directors approved a simplified code of ethics that sets standards for members' professional conduct. The Institute's current Code of Ethics is based on an earlier Code adopted by a predecessor organization in 1912, and has been modified twice in 1972 and 1987. The revised Code becomes effective on January 1, 1991, and states:

We, the members of the IEEE, in recognition of the importance of our technologies in affecting the quality of life throughout the world, and in accepting a personal obligation to our profession, its members, and the communities we serve, do hereby commit ourselves to the highest ethical and professional conduct and agree to:

- Accept responsibility in making engineering decisions consistent with the safety, health, and welfare of the public, and disclose promptly factors that might endanger the public or the environment;
- Avoid real or perceived conflicts of interest whenever possible, and disclose them to affected parties when they do exist;
- Be honest and realistic in stating claims or estimates based on available data;
- Reject bribery in all its forms;
- Improve the understanding of technology, its appropriate application, and potential consequences;
- Maintain and improve our technical competence and undertake technological tasks for others only if qualified by training or experience, or after full disclosure of pertinent limitations;
- Seek, accept, and offer honest criticism of technical work; acknowledge and correct errors; and credit properly the contributions of others;

- Treat fairly all persons regardless of such factors as race, religion, gender, disability, age, or national origin;
- Avoid injuring others, their property, reputation, or employment by false or malicious action;
- Assist colleagues and co-workers in their professional development and support them in following this Code of Ethics.

Announcement of 1991 MTT-S Newsletter Editor



John Wassel

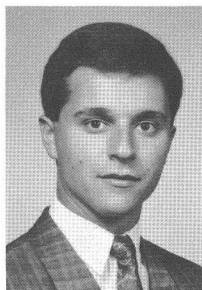
The 1991 MTT-S Newsletter editor will be John Wassel. Our thanks to him for accepting this appointment. A regular schedule for publishing the Newsletter will be re-established in 1991. Deadlines for furnishing copy material to the editor are listed below:

15 February 1991	Spring Issue
15 July 1991	Summer Issue
15 November 1991	Fall/Winter Issue

The deadlines occur approximately one month after the AdCom meetings. Publication takes about six weeks, so you should expect delivery of the Newsletter in April, September, and January. Please forward your comments, letters, news items, and articles of general interest that you think should be published in the Newsletter to:

John Wassel, Editor
c/o Texas Instruments
P.O. Box 655474, MS245
Dallas, Texas 75265, USA

Latest Results on Home Video Tutorials



by Olivier Scaramucci

The following summarizes the latest results on Home Video Tutorials:

I participated in the spring 1990 AdCom meeting of the IEEE/Region 8. I presented the IEEE/MTT-S/LEOS Home Video Tutorial (HVT) program on Emerging Technologies. It is a three years program (1990-1992) covering 24 topics. Region 8 agreed (18 yes, 3 no) to support the program in 1990 at a level of US\$ 5K. As a reminder, the videotapes of the HVT program on Emerging Technologies are created and edited at AT&T Bell Laboratories, Holmdel, New Jersey, USA. The videotapes are then duplicated and sold by the IEEE service center, Piscataway, NJ, USA.

Call for Contribution to the CAEME Catalog

The NSF/IEEE CAEME Center for Computer Applications in Electromagnetics Education is developing a comprehensive catalog of available EM educational software. This catalog will be distributed on diskettes free of charge to all ABET-accredited Electrical Engineering Departments, and to participants of the AP-S, MTT-S, and ACES Symposia. Listing in the catalog provides a valuable opportunity to advertise your software, and contact colleagues who have software of interest to you. If you have or know of an EM educational software package and want to list it in the CAEME Catalog, please call or send the information to:

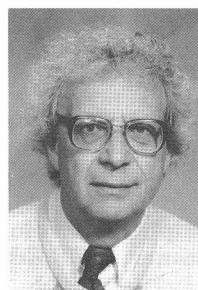
Dr. Magdy F. Iskander
Electrical Engineering Department
3280 MEB
University of Utah
Salt Lake City, Utah 84112
(801) 581-6944

For listing in the catalog, the following information is required:

- Title of software
- Name and address of author(s)
- Availability
- Description of capabilities
- Hardware platform
- Fee, if any

For additional information, please contact Dr. Iskander.

MTT-S Publications

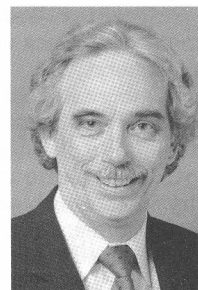


by Martin V. Schneider

The highlights of our current publications activities are as follows:

- A smooth transition of the editorial office from AT&T Bell Laboratories in Holmdel, New Jersey, to UCLA in Los Angeles has been completed.
- Our new editor, Steve Maas, has been successful in publishing the Transactions on schedule. The papers continue to be of first rate quality.
- Steve would like to receive more circuit and system related contributions, particularly papers on recent advances in the field of heterojunction bipolar transistors and circuits.
- All necessary preparations have been made to publish the new Letters Journal entitled "Microwave and Guided Wave Letters." Tatsuo Itoh will be the Editor-in-Chief, and Arye Rosen is in charge of promotion. A call for papers has been distributed both at the International Microwave Symposium and through publication in the Transactions.
- We are always grateful for your feedback. The phone number of the MTT editorial office at UCLA is (213) 825-8628.

MTT Society Ombudsman



Al Estes
Texas Instruments Incorporated
P.O. Box 655474
M/S 404
Dallas, TX 75265, USA
214-995-5230 (w), 214-530-1561(h)
Fax: 214-995-6631
ARPANET E-mail:
ESTES@EXGAAS.TI.COM

If you have complaints about IEEE MTT Society services please contact me using the above information. I prefer mail, E-mail, or faxes so I can easily document the complaints. I will log your complaints, to whom I send it to for resolution, and I will mail you a response that I have received your complaint and what I have done with it. My work to resolve your complaint will continue and the log of your complaint will remain open until I receive information that it has been resolved. I will keep the log in my attache case which travels with me to/from my home and office so that if you telephone me I can give you an immediate status on your complaint. You may call me at home between 0600 am to 0730 am, or between 0700 pm to 1000 pm on weekdays; or between 0800 am to 1000 pm on weekends. You may reach me in my office between 0800 am to 500 pm, Monday through Friday. I am out of the office 1130 am to noon for lunch. All times are Central Standard time.

IEEE Home Video Tutorials on Emerging Technologies

Co-produced by
Lynden U. Kibler, IEEE/MTT
Ralph Trabarulo, Two Thousand Plus Inc.
Peter Wiesner, IEEE Educational Activities Department

The Impact of Coherent Detection Techniques on Terrestrial and Planetary Atmospheric Research, and on the Discovery of Interstellar Molecules*, by Pierre Encrenaz, Observatoire de Paris, 92190 Meudon, France.

Coherent detection techniques of millimeter and submillimeter-waves have dramatically improved in the last two decades. The cooling of Schottky receivers, the use of both homo- and pseudomorphic HEMTs, and the technology of superconducting (SIS) junctions have increased the receiver sensitivities by two orders of magnitude. Interstellar molecules which could barely be detected in the seventies are now being observed with radiotelescopes in a few seconds. The detections of deuterated species, of acetone, sodium and potassium chloride show that the interstellar medium is far more complicated than previously assumed.

While the astronomical observations need to be done from high altitude sites (high platforms, balloons, airplanes, satellites), the telluric lines (molecular oxygen, water vapour, ozone) can be observed from both the ground and from space. The data obtained from the atmospheric studies will permit more accurate short and long range weather predictions.

Quasioptical System Design for Millimeter Wavelengths, by Paul F. Goldsmith, Department of Physics and Astronomy, University of Massachusetts, Amherst, MA.

Quasioptical propagation is gaining increasing acceptance as a valuable transmission medium for millimeter wavelengths. A wide variety of radar and radiometric systems and subsystems have been developed using quasioptical techniques. Quasioptical systems depend on availability of building blocks or components for carrying out particular functions. Some of these are quite similar to waveguide approaches used at longer wavelengths, and some derive from infrared and optical technology.

Quasioptical propagation using Gaussian beams (Gaussian optics) has been the basis of most system designs employing free space transmission. The lecture reviews the basics of Gaussian beam propagation, and the Gaussian optics components which have proven especially useful.

High Performance Field Effect Transistors, by Lauren F. Palmateer, School of Electrical Engineering, Cornell University, Ithaca, NY 14853.

Over the past few years, AlInAs/GaInAs/InP Modulation Doped Field Effect Transistors (MODFETs) have proven superior device performance over the more conventional AlGaAs/GaAs MODFET and have attracted a great deal of attention for

low noise millimeter-wave device applications. DC and rf device characterization of high performance 0.2 μm gate length AlInAs/GaInAs/InP MODFETs are presented. Unity current gain cutoff frequencies of 100 to 120 GHz and maximum frequencies of oscillation in excess of 180 GHz are reported.

Transport phenomena effecting the performance of the MODFETs are discussed. Hot electron effects have been observed in 0.2 μm gate length AlInAs/GaInAs/InP MODFETs at both dc and at rf frequencies. These results demonstrate that real space transfer of electrons out of the GaInAs quantum well is occurring. These MODFETs show improved performance at dc and microwave frequencies.

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IEEE Microwave and Guided Wave Letters

A Call for Papers



by Tatsuo Itoh
 Editor-in-Chief
 Dept. of Electrical Engineering
 66-147A ENG IV
 University of California, Los Angeles
 405 Hilgard Avenue
 Los Angeles, CA 90024-1596
 Telephone: (213) 206-4820
 Fax: (213) 206-4819

The IEEE Microwave Theory and Techniques Society (MTT-S) announces a new monthly journal offering fast publication of original research relevant to all aspects of microwave/millimeter-wave technology, with emphasis on components, devices, circuits, guided wave structures, systems and applications covering the frequency spectrum from microwave to infrared.

IEEE Microwave and Guided Wave Letters, to begin publication in January 1991, will offer the opportunity to publish short, archival contributions appearing with minimal delay. The journal will be priced competitively with other publications, ensuring circulation to a large number of individuals and institutions. Members of the IEEE MTT Society will receive the journal free of charge for the first year of publication.

Original contributions are solicited which relate advances or state-of-the-art capabilities in theory, design, fabrication, performance and reliability of:

- solid state devices and circuits; ferrites; superconductor applications; acoustics; high power; biological effects and medical applications; low noise; packaging; industrial and consumer applications;
- guided wave structures; network theory; computer aided design; microwave field theory;
- lightwave technology; microwave systems; digital signal processing; microwave measurements; manufacturing technology;
- millimeter wave and submillimeter wave techniques.

Publication time will be within 3 months of receipt providing that the authors respond immediately to all communications (utilizing fax machines and electronic mail where feasible). Four copies of the manuscript and the original illustrations should be submitted directly to the Editor-in-Chief. Details for manuscript preparation and submission are given in the "Information for Authors" and must be strictly adhered to in order to expedite the publication process.

(Please refer to the Author Check List to be submitted with manuscript)

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IEEE Microwave and Guided Wave Letters is published monthly with the purpose of providing fast publication of original and significant contributions relevant to all aspects of microwave/millimeter-wave technology, with emphasis on devices, components, circuits, guided wave structures, systems and applications covering the frequency spectrum from microwave and beyond, including submillimeter-waves and

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It is the intention of the Editors that the contents of this journal shall be intelligible and interesting to nonspecialists as well as to experts in the field of the particular contribution. Accordingly, authors are earnestly requested to submit their work to the scrutiny of a colleague who is not familiar with the details of the work beforehand. Criticisms may well indicate areas in which other readers will have difficulty in understanding the author's intentions.

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References should be started on a separate sheet of paper, and must be double-spaced.

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Illustrations

Original illustrations should be submitted along with three sets of copies for the reviewers. The originals will be returned. All line drawings (graphs, charts, diagrams, etc.) should be prepared on white drafting cloth or white drawing paper in black India ink. Charts should show only the axes and perhaps major coordinate lines. Photostatic copies of drawings are acceptable only when they are exceptionally clear and have high contrast.

Lettering should be large enough to be readily legible when the drawing is reduced to two- or one-column width — as much as 4:1 reduction from the original. In the original size, this lettering may appear too large, but the reader will benefit. Lettering on figures is preferably done by template.

Authors are warned specifically about difficulties with figures prepared using simple dot matrix printers. In particular, they are warned that use of computer notation as Fortran

notation for powers of ten (e.g., 1E-10) or for labels on axes (e.g., [Hertz]**1/2) is not acceptable. In addition, figures produced by dot matrix printers are susceptible to line widths that are too small, labeling that is too small for reproduction, and pips on scales that are too small for reproduction.

Photographs should be used sparingly. A good line drawing for apparatus is usually more informative than a photograph. Photographs of oscilloscope traces should be of high contrast, without spurious marks due to halation or unblanked traces. All photographs must be glossy prints.

All materials, including drawings and photographs, should be no larger than 22x28 cm (8 1/2 x 11 in).

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Dept. of Electrical Engineering
66-147A ENG IV
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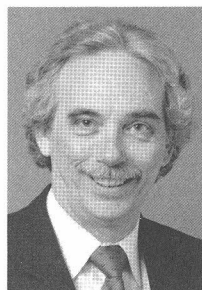
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Membership Services Committee Report



Alton L. Estes
Co-Chairman



Steven J. Temple
Co-Chairman

Our committee worked hard in 1990 to offer our Members quality services as evidenced by the following highlights:

- Our numbers of MTT-S Chapters has grown to 70 (a 30% increase since 1986) with the formation of two more Chapters: Hungary and Poland.
- Our Society ranks 4th in IEEE for total number (70) of Chapters and 6th in total (10,415) Membership.
- The Distinguished Microwave Lecturer Program has flourished with three new Distinguished Lecturers being named and twenty-five Distinguished Lectures being presented in 1990.
- The Speakers' Bureau Program is in transition with five of the original 10 Lecture topics continuing in 1991 and one more having been added. Four more Topics will be added Winter 1990/1991.
- Copies of the 1990 Chapter Officer's Handbook were distributed to all Chapter Chairs.
- Approved travel support to 19 Chapters to assist representation at the 1990 Chapter Chairmen's Meeting held at the recently completed 1990 IEEE MTT-S IMS. Representatives from 31 Chapters attended the meeting.
- Provided Chapter Activities (technical meetings) support to 19 Chapters since September 1989.

We express special appreciation to Zvi Galani who left the committee following 4 years as Chapter Records Officer and 3 years as Associate Newsletter Editor, and to Fazil Ali who has served 2 years directing membership development. We recognize the significant contributions these individuals have made to our Society.

The following is written to explain why adding Chapters and Members is so important, or is touted as a service to our Membership. First, adding Chapters:

- Less than 70% of our Membership was affiliated with Chapters as recent as the end of 1985. Since then we have added 26 Chapters and 2 Chapters were disbanded. Currently, our Society has over 79% of our Members affiliated with Chapters. This leaves roughly 2,000 Members who are not served by Chapter activities.
- MTT-S, through our committee's Chapter Activities subcommittee, provides up to \$500 meetings support to Chapters who request such support and meet the support guidelines. Together, the Distinguished Lecturer Program and the Speakers' Bureau Program, coordinated by Lewis Medgyesi-Mitschang, are funded \$24,000 to provide co-funded (with employers) support for travel to the Distinguished

Lecturers and the Speakers' Bureau speakers. Together, these two Programs are expected to provide around 60 to 80 presentations each year to Chapters.

So you can see that roughly 2,000 of us are not being served by the above services. We (AdCom, the committee) want all of our Members to receive the benefits of Membership. Charter petitions require 10 signatures of higher grade IEEE/MTT-S Members. If you are among the 2,000, please help us charter Chapters within IEEE Sections who do not have MTT-S Chapters. Write, call, fax, or send E-mail to Al Estes for assistance.

Secondly, why add MTT-S Members? Your IEEE Section receives from IEEE in the form of an annual rebate the following:

- \$0.70 per Society Member.
- It also receives \$50 for the first 5 reported technical meetings, and \$35 thereafter.

All of this rebate is supposed to directly support your Chapter. The key here is . . . If or do you have a Chapter? If you do not have an MTT-S Chapter in your Section, the Section keeps the money for its use, and you and your other Section Members who belong to the MTT-S lose the money. By the way, your IEEE Section receives \$4 for each IEEE Member within the Section to support Section activities.

We hope you are becoming more interested in chartering an MTT-S Chapter now. Why? Because you and your colleagues are the big losers if you are among the 2,000 MTT-S Members not in Sections with MTT-S Chapters. We are here to help you. Help us help you get more benefits. Help charter an MTT-S Chapter.

The value of Membership Services

The 1989 cost for the services which were received by our Membership according to a recent report by Barry Perlman follows:

1989 Fixed Expenses:

Publications	\$174,900
Membership	\$ 57,500
Operations	\$105,800
Educational	\$ 46,000
Intersocietal	\$ 1,700

Subtotal \$385,900

1989 Variable Expenses:

Publications	\$346,861
Total Expense for Members	\$732,761
Expense/Member	\$66.40
less income from dues (avg.)	\$ 9.84
*Average Benefit	\$56.56
Benefit using \$12.00 dues	\$54.40

*Income from Member dues = \$108,600 or \$9.84 per Member.

The main point of this is that for \$12.00 annual dues the Members are getting another \$54.40 in extra dollar value for services rendered. This extra value covers services such as the Transactions, Newsletters, support for Chapter meetings,

Distinguished Lectures and Speakers' Bureau talks, Fellowships, Scholarships, and so on. The Transactions cost around \$2.00 per month.

We hope our Membership sees value in these services that are currently delivered at a cost of \$732,761 (in 1989). Let us know what you think. Write, call, fax, or E-mail your opinions to us. We care.

Ombudsman Service

Bill Mitchell's report on the Membership Booth operated at the 1990 IEEE MTT-S IMS included many problems which were brought to his attention. Al Estes has noted similar quantity of problems during the 3 times he has managed membership booths. Al has noted some of the problems could have been handled prior to a Member traveling to the IMS. We feel that the quantity of problems is much higher, as the feedback we get at the membership booths is probably a very small sample of what is going on.

We are adding another service to our Committee. Al Estes will be our Society's first Ombudsman. An Ombudsman receives or hears Members' complaints and he sees that these complaints are resolved. Please contact our Ombudsman, Al Estes, if you have complaints concerning IEEE or MTT-S. Al has served on the IEEE Membership Development Committee (an IEEE BoD committee reporting through RAB) as the Division VI representative for the past two years. He has been involved in various IEEE Section or MTT-S activities since 1979 and will be able to use his understanding of how IEEE and MTT-S works to solve our Members' complaints. We feel this service could be one of the more effective and beneficial services MTT-S can offer through our committee.

In conclusion

Our committee has provided much service to our Members. We continue to attempt better service.

We sadly recognize that one of us has fallen down in his responsibility. Three Newsletters were not delivered to our Membership this year or on time. We know that when Gary Lerude agreed in Winter 1989/1990 to be Newsletter editor he and his employer made commitments to provide resources that were necessary. What no one knew, including Gary, was that Gary's free time would be cut to zero in the first part of 1990 due to an unplanned drastic increase in his workload for all of 1990. Gary has been our Society's Secretary, and has been elected to AdCom. He has performed other AdCom duties. We are appreciative for what he has done. We hope that Gary will be able to return to volunteering his time in the future.

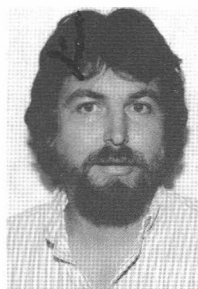
This incidence should remind us that we are all volunteers and as such can only do what we can. We all have "real jobs." Gary's "real job" included managing a major proposal which ended up being won by his employer just as this Newsletter was being developed.

Many jobs were saved for Gary's colleagues. In this day of RIFs, we believe saving jobs for your employer and fellow microwave engineers is important. We are pleased that Gary volunteered to be our Newsletter editor. We are sad that circumstances prohibited Gary from delivering.

But any time someone like Gary gets an opportunity to volunteer, sees that the resources are available to accomplish the request, the response should always be . . . Can Do!

Volunteering can be a risky business. Be a risk taker! Volunteer to help your Chapter, Section, or Society.

Ok . . . to . . . beer . . . fest in Toronto



by Mike Golio
IEEE MTT-Society
Chapter Activities Chairman

On October 5-7, I was able to attend the IEEE Sections Congress representing the MTT-Society. It was a very enjoyable and informative three days. When you have survived 122° summer days in Phoenix, a few days in Toronto is almost certainly going to be enjoyable. But the Sections Congress provided more than perfect autumn weather.

Now, before I go into all the official stuff about IEEE, the MTT-Society and all the work we accomplished, let me assure you that those of us who attended the Sections Congress had a good time. We were greeted the first night we arrived in Toronto to a reception hosted by Region 7. (For those of you as ignorant as I was only a few months ago, Region 7 covers all of Canada.) There was plenty of food and good, cold Canadian beer. The Region 7 membership also sold neckties with the IEEE Region 7 logo on them. The reason I mention the tie sales is because I purchased one of them and I will expect all of you to be extremely jealous the next time you see me with it on (hopefully at the MTT-Symposium in Boston). Friday evening was Oktoberfest. Each of us was asked to wear a hat or other garb representative of our Region or Section. I chose to wear a cowboy hat and bolo tie and to drink the Canadian beer. The bolo tie is silver and turquoise and is also cause for extreme envy. Finally, on Saturday evening, the Medals Ceremony and dinner was held. I wore my MTT tie to this event. (These ties were given as an attendance gift at the Symposium a few years ago.) There was also more Canadian beer involved.

In between these festive events, the attendees focused on developing issues and recommendations to be presented to the IEEE board of directors. This was accomplished through a series of Tutorials, Plenary Sessions and Breakout Sessions. I presented information about the MTT-Society Chapter support programs at one of the Breakout Sessions and was pleased to discover that our Society is considered by many to be the "Blue Chip Society of the IEEE."* After two days of meetings, the Congress came up with a list of 26 prioritized issues and recommendations that we felt needed to be addressed by our IEEE board of directors. This list will be presented to the board at their next meeting.

The next Sections Congress will be scheduled for 1993. If I see you there, we can discuss the quality of the local beer and my outstanding collection of ties.

*Although the concept was expressed in many ways, the actual term "Blue Chip Society of the IEEE" must be credited to Ted Saad. I like it, however, and would encourage all of you to attempt to use it as often as possible in conversation. For example you might try, "Your comments concerning the impact of heavy metal rock and roll music on engineering practice remind me of the fact that many people consider the MTT-Society to be the Blue Chip Society of the IEEE."

MTT-S Speakers' Bureau



by Lewis Medgyesi-Mitschang

The MTT-S Speakers' Bureau was established in 1988 by the MTT-S to provide continuing education to Members on a large number of technical topics. The topics were chosen to inform our Members about advanced or emerging microwave devices, circuits, circuits analysis, or systems. The Members of the Bureau are nationally recognized leaders in their field of interest. They have agreed to give up to six lectures during 1990 and 1991. Five of the original ten topics have been removed and one new one has been named. The abstracts and biographies for the three new Speakers, along with a table which summarizes all the information about the Bureau follows.

The Design of MMIC Circuits Through Computer-Aided Simulation

*by Raymond S. Pengelly,
Rowan J. Gilmore
Compact Software Inc.
483 McLean Blvd.
Paterson, NJ 07504*

*and
Michael B. Steer
Department Electrical and Computer Engineering
North Carolina State University
Raleigh, NC 27695*

Abstract

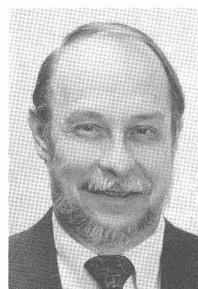
Microwave and millimeter wave monolithic integrated circuits have moved from being laboratory curiosities to available components during the last decade. Chief among their numerous advantages are the reduction in unit cost, associated with the achievement of uniform circuit response and the consequent elimination of post-process tuning.

MMIC chips of necessity, therefore, must conform to the design specification well before the production phase. Modern computer simulation tools have become an integral part of the design process, and help ensure that response specifications are consistently met.

In this lecture, the background theory to circuit design is explored. The capabilities of linear and nonlinear computer simulation techniques to model and optimize circuit response and yield are developed, and the limitations of the various methods discussed. In particular, the harmonic balance technique is shown to be an effective and useful tool for the simulation of nonlinear microwave circuits. The analysis of noise, yield, and nonlinear responses in MMIC circuits is also presented, within a workstation environment specifically developed for the design of GaAs MMIC chips.

Later in the lecture, various MMIC models and common building blocks are illustrated. A broadband MMIC amplifier

Announcement of 1991 MTT-S Newsletter Editor



John Wassel

The 1991 MTT-S Newsletter editor will be John Wassel. Our thanks to him for accepting this appointment. A regular schedule for publishing the Newsletter will be re-established in 1991. Deadlines for furnishing copy material to the editor are listed below:

15 February 1991
15 July 1991
15 November 1991

Spring Issue
Summer Issue
Fall/Winter Issue

The deadlines occur approximately one month after the AdCom meetings. Publication takes about six weeks, so you should expect delivery of the Newsletter in April, September, and January. Please forward your comments, letters, news items, and articles of general interest that you think should be published in the Newsletter to:

John Wassel, Editor
c/o Texas Instruments
P.O. Box 655474, MS245
Dallas, Texas 75265, USA

is analyzed in its entirety, showing some novel ways in which designers can achieve good efficiency and high power over as broad a bandwidth as possible. The design is developed schematically, analyzed, layed out, and compared with measured results from the actual MMIC chip. This lecture should be invaluable to all microwave designers and their managers who wish to update their understanding of the design process with real-world experience.

Biography

Raymond S. Pengelly

Raymond Pengelly received his M.Sc. in Electronics from the University of Southampton, England, in 1973. In 1974 he was responsible for the successful design of the world's first GaAs MMIC amplifier at Plessey Applied Research laboratories. In 1981 he became manager of the GaAs IC department at Plessey Research and Technology Ltd., and in 1985 was made Research Executive with responsibility for the coordination of advanced microwave and electro-optic research and pilot production. In 1986 he moved to the USA and became Executive Director of Engineering at Tachonics Corporation.

He is presently Vice President of Sales and Marketing at Compact Software, where he has been responsible for the market introduction of the Serenade Microwave Design Workstation and other new software products, as well as device characterization services and wide-ranging technical seminars.

Ray Pengelly is a Fellow of the Institution of Electrical Engineers and a Member of the Institution of Electrical and Electronic Engineers. He was awarded the 1979 European

Microwave Prize, has written over 65 papers, holds 3 patents, and has written 3 books on microwave field-effect transistors and MMICs.

Rowan J. Gilmore

Rowan Gilmore obtained his B.E. (Elec. Hons) degree from the University of Queensland in 1976, and his D.Sc. degree from Washington University in St. Louis in 1984. He has held design positions with the Overseas Telecommunications Commission, Central Microwave, and Schlumberger Technologies, in the United States and abroad.

He is presently Vice-President of Engineering at Compact Software, where he has managed the development of Microwave Harmonica and SuperCompact. His interests are in nonlinear circuit simulation and active device modeling.

Michael B. Steer

Michael Steer received his Ph.D. in Electrical Engineering from the University of Queensland, Brisbane, Australia, in 1983 and is currently Assistant Professor of Electrical and Computer Engineering at North Carolina State University.

His research involves the simulation and computer-aided design of nonlinear analog circuits with large-signal excitation, and of circuits with mixed analog and digital signals. He is currently working on the simulation of microwave analog circuits, delta-sigma modulators, high speed printed circuit boards, and the computer-aided design of analog circuits using simulated annealing.

Dr. Steer was named a Presidential Young Investigator in 1987.

MTT-S Speakers' Bureau

MTT SPEAKERS BUREAU (SB) / VIDEOTAPE LECTURES (VT) / SUMMARY INFORMATION				
Lecturer	Affiliation	Topic	VT	SB
Raymond S. Pengelly Rowan J. Gilmore Phone: (201) 881-1200 Fax: (201) 881-8361 Michael B. Steer Phone: (201) 737-2336	Compact Software Inc. 483 McLean Blvd. Paterson, NJ 07504 Department Electrical and Computer Engineering North Carolina State University Raleigh, NC 27695	The Design of MMIC Circuits through Computer-Aided Simulation		X
Heinrich Daembkes Phone: 47-731-392-4272	AEG Research Center Sedanstrasse 10, D-7900 Ulm West Germany	Microwave and Millimeter-Wave HEMT Devices and Circuits		X
Pierre Encrenax Phone: 33-45-347530 Fax: 33-45-342151	Observatoire de Paris 92190 Meudon, France	The Impact of Coherent Detection Techniques on Terrestrial and Planetary Atmospheric Research, and on The Discovery of Interstellar Molecules		X
Richard E. Howard Phone: (201) 949-5952 Fax: (201) 948-8966	AT&T Bell Laboratories Crawford Corner Road Holmdel, NJ 07793	High TC Superconductivity: Facts and Fancy	X	
Michael Wengler Phone: (716) 275-9402 Fax: (716) 275-0135	Dept. of Electrical Engineering University of Rochester Rochester, NY 14627	Submillimeter Heterodyne Detection with Superconductive Electronics		X
Bernard Yurke Phone: (201) 582-4961	AT&T Bell Laboratories 600 Mountain Avenue Murray Hill, NJ 07974	Quantum Noise in Microwave and Millimeter-Wave Electronics		X

1990 Membership Booth a Success



*by Bill Mitchell
Co-Manager, Membership Booth
and Dallas IEEE MTT-S Chapter
Membership Development Chairman*

Tom Campbell, Membership Development Chair for the AP Society, and myself co-managed the membership booth at the recent 1990 IEEE MTT-S and IEEE AP-S International Symposia. The booth was very successful thanks to all the volunteers who assisted. Our special thanks go to both Steering Committees for allowing a Membership promotion which included a \$40 reduction in IEEE enrollment fees (to come from non-member registration fees of the Symposia) for those Symposia delegates who enroll with IEEE and either MTT-S or AP-S at the membership booth.

We enrolled 147 Symposia delegates into IEEE as higher grade Members. Of these, 136 enrolled with MTT-S for FREE, and 85 enrolled with AP-S for FREE. Of the 85 who enrolled with AP-S, 74 also enrolled with MTT-S for FREE. Also, 12 IEEE Member delegates enrolled into AP-S for FREE. Therefore, we added 166 Members to MTT-S and 97 Members to AP-S along with enrolling 147 IEEE Members.

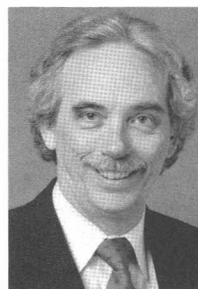
We enrolled 17 student delegates into IEEE as Student IEEE Members. Of these, 10 enrolled with MTT-S for FREE, and 6 enrolled with both MTT-S and AP-S for FREE. Also, 2 students enrolled with MTT-S for FREE.

We assisted 2 delegates to complete IEEE reinstatement forms, and 3 IEEE Members to join Societies other than MTT-S or AP-S.

We received a number of problems or complaints, as follows:

1. **Edward KN Yung #1873371 SM**
City Polytechnic of Hong Kong
Problem: ?
2. **Yau Yat Chuen**
Kowloon, Hong Kong
Problem: ? (but I think that 1 and 2 have same problem)
3. **Anthony Kikel #0384701**
Problem: Wrong name in database. Change Rickel to Kikel.
4. **Baumer Claus and Ningyan Zhu #0537852**
Problem: Sometimes doesn't receive publications. Once Akk Lau received publications for entire city.
5. **Victor Steel #10237**
Problem: Has not received MTT-S journal for 1½ years.

MTT Society Ombudsman



Al Estes
Texas Instruments Incorporated
P.O. Box 655474
M/S 404
Dallas, TX 75265, USA
214-995-5230 (w), 214-530-1561(h)
Fax: 214-995-6631
ARPANET E-mail:
ESTES@EXGAAS.TI.COM

If you have complaints about IEEE MTT Society services please contact me using the above information. I prefer mail, E-mail, or faxes so I can easily document the complaints. I will log your complaints, to whom I send it to for resolution, and I will mail you a response that I have received your complaint and what I have done with it. My work to resolve your complaint will continue and the log of your complaint will remain open until I receive information that it has been resolved. I will keep the log in my attache case which travels with me to/from my home and office so that if you telephone me I can give you an immediate status on your complaint. You may call me at home between 0600 am to 0730 am, or between 0700 pm to 1000 pm on weekdays; or between 0800 am to 1000 pm on weekends. You may reach me in my office between 0800 am to 500 pm, Monday through Friday. I am out of the office 1130 am to noon for lunch. All times are Central Standard time.

6. **Tom Burgher II**
Anharen Microwave Inc.
6635 Kirkville Road
Syracuse, NY 13057
Problem: Requested copy of video: "Echos of War."
7. **David Ganow #4971107**
Problem: Has not received 1990 renewal invoice from IEEE.
8. **Fabrizio Frezza #8375743**
Problem: Continuing his studies. Form included.
9. **Sue Chester**
Problem: Didn't receive 1½ membership as promised.
10. **Jean-Louis Bonnefoy**
Problem: Not receiving any MTT-S journals, etc. Address included.

ADDRESS CHANGES:

Branka Jokanovic
IMTEL — Institute for Microwave Techniques & Electronics
Bulevar Lenjina 165b
11070 Belgrade
Yugoslavia
Phone: 011-38-11-135420 x 127
Fax: 011-38-11-559247

MTT-S Chapter Meetings



by Joe Staudinger
Motorola GEG
G-1218
2501 South Price
Road
Chandler, AZ
85248-2899
Phone
(602) 732-2803
Fax (602) 732-2148

Presented below is a list of meetings held by MTT-S Chapters. We know our Chapters are very active. However, this list indicates that since June 1989 only 59% of the Chapters have reported their technical meetings. Please help me keep up to date records by sending me the appropriate information. My address, telephone and fax are listed above.

ALBUQUERQUE (MTT/AP/EMC)

- Lawry, Dean, Air Force Systems Command Weapons Laboratory, Kirtland AFB, NM, "EMP Test Aircraft Program," 6/29/89. Attendance: 15.
- Gahl, John, Univ. of New Mexico, Albuquerque, NM, "Pulse Power and Plasma Science at the University of New Mexico," 8/22/89. Attendance: 15.
- Bennett, Scott, Hewlett-Packard Co., Fort Collins, CO, "Neglected Aspects of Radiated Emissions Testing," 9/19/89. Attendance: 15.
- Steinberg, Bernard, Univ. of Pennsylvania, Philadelphia, PA, "High Resolution Microwave Imaging," 10/12/89. Attendance: 25.
- Miller, Ed, LANL, Los Alamos, NM, "Parameter Estimation in Electromagnetics," 2/20/90. Attendance: 24.
- Merrewether, David, EMA, Albuquerque, NM, "Phased Array Antenna as an HPM Source," 3/1/90. Attendance: 21.
- Sampagne, Steve, LLNL, Livermore, CA, "Beam Research Program at LLNL," 3/8/90. Attendance: 10.
- Clark, Wallace T., BDMMSC, KAFB, Albuquerque, NM, "Transient Analog Data Fiber Optic Links: A Comparison," 3/27/90. Attendance: 13.
- Nitsch, Jurgen, AFSC/WL, KAFB, ABQ, NM, "Commutative Multiconductor Transmission Line Tubes," 4/25/90. Attendance: 12.

ATLANTA (MTT/AP)

- Ricardi, Leon J., L. J. Ricardi Inc., "Multi-Beam Antennas," 11/15/88. Attendance: 26.

- Hovanessian, S. A., Aerospace Corp., Los Angeles, CA, "Synthetic Aperture Radar," 1/18/89. Attendance: 30.
- Cooke, William P., Georgia Tech Research Institute, Atlanta, GA, "Sierra Phased Array Antenna," 2/22/89. Attendance: 20.
- Cantafio, Leopold, TRW Space and Technology Group, Redondo Beach, CA, "Space Based Radar Systems and Technology," 3/14/89. Attendance: 22.
- Peterson, Andrew, Georgia Tech, Atlanta, GA, "Electromagnetic Analysis of Complex Scattering: Research Progress of the 1980s," 10/17/89. Attendance: 30.
- Richardson, Philip N., Texas Instruments, Dallas, TX, "Slotted Waveguide Antenna Arrays," 1/17/90. Attendance: 29.
- Weber, Mark E., MIT Lincoln Laboratory, Lexington, MA, "Aviation Weather Hazards and Their Detection with Airport Radars," 2/13/90. Attendance: 29.
- Schwering, Felix K., U.S. Army LABCOM, Fort Monmouth, NJ, "Millimeter Wave Antennas," 3/13/90. Attendance: 27.

BUFFALO (MTT/AP)

- Burin, Mark, Bell Electronics of Ontario, Ontario, Canada, "Radar Detectors," 4/6/89. Attendance: 24.
- Hovanessian, S. A., The Aerospace Corp., Los Angeles, CA, "Sensor Systems — From Microwave to Electro-Optical," 10/19/89. Attendance: 41.
- Litra, John, McMaster University, Hamilton, Ontario, Canada, "Integrated Microstrip Phased Array Antennas," 11/9/89. Attendance: 22.
- White, John, Wavetek, Suffern, NY, "New Scalar Techniques Using Precision Power Measurements to Solve Accuracy Problems," 12/21/89. Attendance: 10.
- Schwering, Felix K., U.S. Army Communications-Electronics Command, Fort Monmouth, NJ, "Millimeter Wave Propagation in Vegetation," 2/16/90. Attendance: 15.

CENTRAL AND SOUTH ITALY (MTT/AP)

- Bucci, O. M., University of Naples, Italy, "Reflector Antenna Synthesis," 5/12/88. Attendance: 70.
- Solimini, D., University of Tor Vergata, Rome, Italy, "Microwave Remote Sensing of the Earth Surface," 5/19/88. Attendance: 40.
- Franceschetti, G., University of Naples, Italy, "Processing of SAR Signals," 10/26/88. Attendance: 50.

- Steinberg, Bernard D., University of Pennsylvania, Philadelphia, PA, "High Resolution Microwave Imaging," 1/24/89. Attendance: 35.
- Gwarek, W., Warsaw University of Technology, Warsaw, Poland, "Finite-Difference Time-Domain Analysis of Two-Dimensional Microwave Circuits," 2/15/89. Attendance: 25.
- Munson, Robert E., Ball Aerospace, Boulder, CO, "Microstrip Antennas: Principles and Applications," 3/22/90. Attendance: 80.

CENTRAL NEW ENGLAND/ BOSTON (MTT)

- Chu, Alejandro, M/A-COM, Burlington, MA, "Glass Circuits — An Auxiliary Technology to GaAs MMICs," 9/20/89. Attendance: 33.
- Adamian, Vahe, Automatic Testing and Networking, "On-Wafer Noise and S-Parameter Characterization," 4/25/90. Attendance: 22.
- Curtice, Walter, R., W.R. Curtice Consulting, Princeton Junction, NJ, "Nonlinear GaAs FET Modeling, A Mixture of Art and Science," 5/23/90. Attendance: 32.

CHICAGO (MTT/AP)

- Shubinsky, Gary, Basic Industry Research Labs, Evanston, IL, "Optoelectronic Devices for Microwave Operation," 3/30/89. Attendance: 10.
- Wong, Thomas, IIT, Chicago, IL, "Spectral Summation Methods for Pulse Propagation and Transient Analysis," 5/22/89. Attendance: 10.

CLEVELAND (MTT/ED/LEO)

- Brown, April, US Army Research Ctr., Presentation of MTT Video Tape Lecture: "GaInAs Heterostructures for Low Noise Amplification, High Speed Circuits, and Lightwave Detection," 7/5/90. Attendance: 24.
- Jansen, Rolf, Plessey Microwave, "MTT Videotape Lect. Microwave and Millimeter Wave MIC's," 7/12/90. Attendance: 22.
- Niehenke, Edward, GE, MTT Videotape Lecture "GaAs — Key to Modern Microwave Technology," 7/19/90. Attendance: 23.
- Howard, Richard, ATT Bell Labs., MTT Videotape Lecture: "High Temperature Superconductivity — Facts and Fancy," 7/26/90. Attendance: 27.
- Knerr, Reinhard H., ATT Bell Labs, MTT Videotape Lecture: "Lightwave Communications," 8/2/90. Attendance: 19.

COLUMBUS (MTT/AP)

- Kobayashi, Kazuya, Chuo University, Japan, "The Wiener-Hopf Technique and its Applications to the Diffraction Theory," 7/5/89. Attendance: 31.
- Hodge, Dan, Ohio State University, Columbus, OH, "What's New in the EE Dept.," 10/18/89. Attendance: 122.
- Leonard, Regis F., NASA Lewis Research Center, Cleveland, OH, "Solid State Microwave Technology at NASA Lewis Research Center," 2/8/90. Attendance: 28.
- Altintas, Alhan, Bilkent University, Ankara, Turkey, "Analysis of Wave Propagation in Curved and Twisted Dielectric Optical Waveguide Using Volume Equivalent Currents," 5/15/90. Attendance: 26.

DALLAS (MTT)

- Cendes, Zoltan, Carnegie-Mellon Univ., Pittsburgh, PA, "The Finite Element Revolution in Microwave Design," 9/28/89. Attendance: 35.
- Maas, Stephen A., The Aerospace Corp., Los Angeles, CA, "Rethinking the High Performance Mixer," 10/26/89. Attendance: 58.
- Hassun, Roland, Hewlett-Packard Co., Palo Alto, CA, "Signal Simulation," 2/20/90. Attendance: 29.

DAYTON (MTT/AP)

- Walton, Eric K., The Ohio State University, Columbus, OH, "Maximum Entropy Imaging Techniques," 6/14/89. Attendance: 29.

DENVER-BOULDER (MTT/AP)

- Steinberg, B. D., Univ. of Pennsylvania, Philadelphia, PA, "High Resolution Microwave Imaging," 10/18/89. Attendance: 30.
- Stein, S., Ball Aerospace, Broomfield, CO, "The Development of a Compact Hydrogen Maser," 11/16/89. Attendance: 33.
- Schwering, F., US Army LABCOM, Fort Monmouth, NJ, "Millimeter Wave Propagation in Vegetation," 1/18/90. Attendance: 35.
- Miers, Tom, Ball Aerospace, Broomfield, CO, "Wafer Level Microwave/Millimeter Wave Measurements in the MIMIC Program," 4/27/90. Attendance: 20.

EGYPT (MTT/AP)

- Sami, Rahmat, JPL, "Antennas for Space Applications," 9/7/87. Attendance: 38.
- Sanad, Mohamed S., Cairo University, Giza, Cairo, "Dual Cylinder Reflectors and Applications in Radar Sat. Ant.," 12/30/87. Attendance: 20.

- El-Sayed, Osman, C.V. NTI, Cairo, "Statistical Characterization of Single Frequency Fades in the Egyptian Delta," Sylvain, Mochel, CNET-CRPE, France, "Multipath Modeling of Medium Bandwidth Channels," 2/24/88. Attendance: 53.

- Farrag, Amany, N.T.I., Nasr City, Cairo, "Modal Theory of Elevated and Surface Ducts on L.O.S. Microwave Links," Mahmoud, Samir F., C.V. NTI, Cairo, "Analysis of Multipath Phenomena on L.O.S. Links By Means of Ray Theory," 2/25/88. Attendance: 50.

- Anis, Hussein T., Cairo University, Giza, "Field Exposure Near Power Frequency High Voltage Installation," 4/13/88. Attendance: 8.

- Hashish, Essam, Cairo University, Giza, "Techniques of FM Remote Sensing in Different Frequency Bands," 5/20/89. Attendance: 45.

FINLAND (MTT/AP)

- Tiuri, Martti, Finnish Parliament, Espoo, Finland, "Radio Wave Technology: Past, Present and Future," 12/11/89. Attendance: 95.

- Munson, Robert E., Ball Aerospace, Broomfield, CO, "Microstrip Antennas: Principles and Applications," 3/8/90. Attendance: 16.

- Pospieszalski, Marian, NRAO, Charlottesville, VA, "Recent Advances in Cryogenically Cooled Amplifiers and Receivers," 5/17/90. Attendance: 42.

- Faber, Marek, Warsaw University of Technology, Warsaw, Poland, "Current Microwave and Millimeter Wave Research at the Institute of Electronics of the Warsaw University of Technology," Piotrowski, Jerzy, Warsaw University of Technology, Warsaw, Poland, "Theoretical and Experimental Investigations of Finline Characteristics and Finline Types," 6/7/90. Attendance: 23.

FRANCE (MTT)

- Gardiol, Fred E., Ecole Polytechnique Lausanne, Lausanne, France, "Circuit Analysis, the Integral Approach," Raguene, M., ALCATEL Espace, Toulouse Cedex, France, "Spatial Applications of Printed Antennas," 4/6/90. Attendance: 29.

- Goldsmith, Paul F., Massachusetts University, Amherst, MA, "Quasi-optical System Design for Millimeter Wavelengths," Soares, Robert, A., CNET, Lannan, France, "Microwave Circuit Design Techniques Applied to Lightwave Systems," 6/18/90. Attendance: 31.

HUNTSVILLE (MTT/AP)

- Bradas, James C., U.S. Army MICOM, Redstone Arsenal, Alabama, "Millimeter Wave Application to Military Target Detection and Classification," 1/16/90. Attendance: 28.

- Carnino, Kevin, KOR, "Digital Radio Frequency Memories," 3/23/90. Attendance: 10.

- Rakes, Allen, Teledyne-Brown Engineering, Huntsville, AL, "Acousto-Optical Processing at Microwave Frequencies," 5/4/90. Attendance: 24.

LOS ANGELES (MTT)

- Bhasin, Kul B., NASA-Lewis Research Center, "High Frequency Solid State Electronics: Integration of GaAs, Photonic and Superconducting Technologies," 2/21/89. Attendance: 45.

- Seashore, Chuck, Honeywell Inc., Minnetonka, MN, "GaAs ICs—A Key to Effective Smart Weapons," 3/21/89. Attendance: 25.

- Podell, A., Pacific Monolithics, Sunnyvale, CA, "Monolithics: MMIC Producibility," 3/28/89. Attendance: 40.

- Blauvelt, Henry, Ortel Corp., "RF and Microwave Signal Transmission Over Fiber-Optic Links," 4/18/89. Attendance: 32.

- Alexopoulos, Nicolaos, Univ. of California, Los Angeles, "Recent Advances in Modeling Microstrip Circuits and Antennas," 6/27/89. Attendance: 20.

- Van Duzer, T., U.C. Berkeley, Berkeley, CA, "Broadband Applications of Superconductive Electronics," 1/23/90. Attendance: 70.

- Rohde, Ulrich L., Compact Software, Paterson, NJ, "The Design of a Low Noise VCO Including a Buffer Amplifier," 2/27/90. Attendance: 70.

- Ulaby, Fawwaz T., University of Michigan, Ann Arbor, MI, "Microwave Remote Sensing Applications of Polarimetric SAR," 3/27/90. Attendance: 67.

- Stark, Lawrence, Ortel Corp., "Performance and Applications of Microwave Fiberoptic Delay Lines," 4/24/90. Attendance: 34.

- Chang, David C., University of Colorado, "Modeling of Passive MMIC Circuits Using EM Techniques," 5/21/90. Attendance: 112.

- Rutledge, David, California Inst. of Technology, Pasadena, CA, "Millimeter Wave Cameras," 5/22/90. Attendance: 56.

(cont. on page 52)

MILWAUKEE (MTT/AP/ED/IM)

- Fetter, Richard, Marquette Electronics, Milwaukee, WI, "Microwave Hyperthermia," 9/20/89. Attendance: 15.
- Chari, M. V. K., General Electric Co., Schenectady, NY, "Finite Element Applications to Electrical Engineering Problems," 10/17/89. Attendance: 29.
- Okahata, Darryl, Hewlett-Packard Co., Santa Rosa, CA, "Time Domain Versus Harmonic Balance Methods of Circuit Analysis," 4/1/90. Attendance: 10.
- Sbrockey, Nick, Eaton Corp., Milwaukee, WI, "Diamond Thin Films by Chemical Vapor Deposition," 3/15/90. Attendance: 11.
- Okahata, Darryl, Hewlett-Packard Co., Santa Rosa, CA, "Time Domain Versus Harmonic Balance Methods of Circuit Analysis," 4/1/90. Attendance: 10.

MONTREAL (MTT/AP)

- Huang, C. C., Spar Aerospace, Ste-Anne-de-Bellevue, P.Q., Canada, "An Introduction to Antenna Design for Satellite Communication," 7/31/89. Attendance: 17.
- Li, Tingye, AT&T Bell Laboratories, Holmdel, NJ, "??," 10/12/89. Attendance: 27.

NEW JERSEY COAST (MTT/ED/LEO)

- Sullerberg, Nelson, Bell Communications Research, Red Bank, NJ, "Efficient TDMA and Portable Radio," 3/21/89. Attendance: 47.
- Bahar, Ezekiel, Univ. of Nebraska, Lincoln, Nebraska, "Full Wave Theory Applied to Computer-Aided Graphics for 3D Objects," 9/1/89. Attendance: 21.
- Giles, Randy C., AT&T Bell Laboratories, Holmdel, NJ, "Active Fiber Optics Amplifiers," 10/19/89. Attendance: 24.
- Schwering, Felix, New Jersey Institute of Technology, Hoboken, NJ, "Millimeter Wave Propagation in Vegetation," 11/14/89. Attendance: 3.
- Li, T., AT&T Bell Laboratories, "Lightwave Transmission at Multi-Gigahertz/Sec," 11/16/89. Attendance: 16.
- Kiegler, J., General Electric Astro, Cranberry, NJ, "Advanced Communications Satellites," 1/18/90. Attendance: 29.
- Acumpura, A., Columbia University, New York, NY, "Terabit Lightwave Networks," 5/17/90. Attendance: 12.

- Polakos, Paul, AT&T Bell Laboratories, Murray Hill, NJ, "High Temperature Microstrip Resonators, Filters," 6/21/90. Attendance: 18.

NEW SOUTH WALES (MTT/AP)

- Hansen, R. C., R. C. Hansen Inc., Tarzana, CA, "Superconducting Antennas," 2/16/89. Attendance: 53.
- Staecker, P. W., M/A-COM Inc., Burlington, MA, "MM-Wave Devices, Circuits and Subassemblies: Merging Disciplines for the 1990s," 10/18/89. Attendance: 17.

NORTH JERSEY (MTT/AP)

- Schwering, Felix, New Jersey Institute of Technology, Hoboken, NJ, "Millimeter Wave Antennas," 1/31/90. Attendance: 34.

NEW YORK/LONG ISLAND (MTT)

- Zwillinger, D., Zwillinger, Sousa & Associates, Burlington, MA, "Chaos: A Tutorial," 4/24/90. Attendance: 54.
- Curtice W., W.R. Curtice Consulting, "Nonlinear GaAs FET Modeling, a Mixture of Art and Science," 5/16/90. Attendance: 15.

ORLANDO (MTT/AP)

- Hickman, Hugh, Univ. of South Florida, Tampa, FL, "Superconductivity for Microwave Applications," 9/21/89. Attendance: 16.
- Lowitz, Greg, Hewlett-Packard Co., Palo Alto, CA, "Techniques for Simulating Synthetic Radar Targets, ECM Waveforms and Advanced Modern Threats," 10/18/89. Attendance: 14.
- Pitzalis, Octavius, EESOF, Westlake Village, CA, "State of the Art Circuit and System Simulation," 11/16/89. Attendance: 17.
- Rollman, Jeff, Martin Marietta Electronics, Orlando, FL, "Design of a Ka-Band Monolithic GaAs MESFET Amplifier," 2/15/90. Attendance: 7.
- Steinberg, Bernard D., University of Pennsylvania, Philadelphia, PA, "High Resolution Microwave Imaging and Self Calibration of Large Antenna Arrays," 3/15/90. Attendance: 18.
- Caldwell, Mike, Scientific Atlanta, "High Speed Microwave Measurements for Antennas," 4/19/90. Attendance: 20.
- Hovanessian, S. A., Aerospace Corp, "Radar Principles; Low, Medium and High PRF Radar," 5/17/90. Attendance: 28.

OTTAWA (MTT/AP)

- Osborne, F.J.F., Spar Aerospace Ltd., Quebec, Canada, "From Alouette to MSAT," 1/30/90. Attendance: 48.

- Kent, J., Sutherland, C., CAL, Ottawa, "Mobile Satellite Data Systems," 3/6/90. Attendance: 46.

PHILADELPHIA (MTT/AP)

- Mango, Stephen, Naval Research Laboratory, Washington, DC, "A Look-See at SIR(Shuttle Imaging Radar)-C," 9/27/89. Attendance: 20.
- Shemdin, Omar H., Ocean Research and Engineering, Pasadena, CA, "SAR Ocean Imaging," 10/26/89. Attendance: 10.
- Young, Leo, Office of the Deputy Director of Defense for Research and Engineering, Washington, DC, "The Defense Critical Technologies Plan," 11/8/89. Attendance: 41.
- Stinehelfer, Harold E., Made-It Associates, Lunenburg, MA, "Time Domain," 1/25/90. Attendance: 14.
- Shuchman, Robert A., Environmental Research Institute of Michigan, Ann Arbor, MI, "Microwave Studies of Arctic Sea Ice," 2/22/90. Attendance: 18.
- Roy, Sumit, Univ. of Pennsylvania, Philadelphia, PA, "Subsurface Radar Imaging," 4/25/90. Attendance: 11.
- Wagner, George, Westinghouse Science and Technology Center, Pittsburgh, PA, "Electronic Applications of Superconductors," 5/23/90. Attendance: 7.

PHOENIX (MTT/AP/ED/EMC)

- Withers, Richard, MIT Lincoln Laboratory, Lexington, MA, "Superconductive Microwave Devices and Circuits," 9/7/89. Attendance: 30.
- Dey, Sandwip K., Arizona State University, Tempe, AZ, "Sol-Gel Processing and Properties of Ferroelectric Thin Films on Pt, Si, and GaAs," 10/4/89. Attendance: 12.
- Iverson, A. Evan, Los Alamos National Laboratory, Los Alamos, NM, "Ultra Wideband (Impulse) Radar," 10/19/89. Attendance: 17.
- Aberle, James T., Arizona State University, Tempe, AZ, "Rigorous and Versatile Solutions for Probe-Fed Microstrip Patch Antennas and Arrays," 11/16/89. Attendance: 21.

RIO DE JANEIRO/BRAZIL (MTT/AP/ED)

- Seeds, Alwin, University College, London, England, "Tunable Semiconductor Lasers," "Microwave Optoelectronics, the Contribution of Optoelectronics Technology," 4/8/89. Attendance: 13.

Samii, Rahmat, Univ. of California, Los Angeles, CA, "Large Space Antennas: Novel Design, Analysis and Measurement Concepts," 7/27/89. Attendance: 15.

Herczfeld, eter, Drexel University, Philadelphia, PA, "Research Activities at the Center for Microwave Engineering at Drexel University," Knerr, Reinhard, AT&T Bell Laboratories, Breinigsville, PA, "Lightwave Communications," Daryoush, Afshin, Drexel University, Philadelphia, PA, "Impact of Photonics on Microwave Systems," 7/31/89. Attendance: 23.

SAN FERNANDO VALLEY (MTT)

Long, Stephen I., Univ. of California at Santa Barbara, Santa Barbara, CA, "Microwave Power Amplifiers: HBTs vs. MESFETs," 9/21/89. Attendance: 33.

Wetzel, John, Dynatech, Calabasas, CA, "World Class Manufacturing," 11/16/89. Attendance: 43.

Carr, Kenneth L., M/A-COM Inc., Burlington, MA, "Medical Applications of Microwaves," 1/18/90. Attendance: 52.

Madni, Asad M., Systron Donner Corp., Van Nuys, CA, "Velocity Deception Units for ECM," 2/22/90. Attendance: 35.

Asbeck, Peter, Rockwell Science Center, Thousand Oaks, CA, "Heterojunction Bipolar Transistors for Microwave and Millimeter Wave Applications," 3/15/90. Attendance: 63.

Holz, Gary L., Holz Industries, San Diego, CA, "Packaging Considerations for MIC and MMIC," 4/19/90. Attendance: 52.

SANTA CLARA VALLEY/SAN FRANCISCO (MTT)

Vendelin, George, Vendelin Engineering, Saratoga, CA, "Oscillator Design Using Linear and Nonlinear Techniques," 9/7/89. Attendance: 64.

Riazat, Majid, Varian, Palo Alto, CA, "Coplanar Waveguide — Challenge to Microstrip?," 11/15/89. Attendance: 72.

Cripps, Steve, Celeritek, San Jose, CA, "New Amplifiers for Old," 1/11/90. Attendance: 82.

Matthaei, George L., Univ. of California, Santa Barbara, CA, "Novel Dielectric Waveguide and Microstrip Techniques for MM-Wave Filters and Couplers," 2/8/90. Attendance: 48.

SCHENECTADY (MTT)

Roy, S.K., Calcutta University, Calcutta, India, "Computer Studies of the Properties of Silicon and III-V IMPATT Devices," 9/21/89. Attendance: 31.

Pavlidis, Dimitris, Univ. of Michigan, Ann Arbor, MI, "Characteristics and Performance of Lattice-Matched and Strained Heterostructure Transistors," 3/22/90. Attendance: 34.

Warren, Alan, Thomas J. Watson Research Center, IBM Corp., "Device Design and Fabrication for Quantum Effect Electronics," 4/19/90. Attendance: 28.

SOUTH AFRICA (MTT/AP)

Gericke, J., Plessey, "Low Loss Power Combiners," Perold, W. J., Univ. of Stellenbosch, "Superconductors Microwave Applications," Wolfaardt, P. J., ESD, "Intermodulation Distortion in Mixers," Downing, B. J., UCT, "Microwave Ore Sorting in Diamond Mines," 6/13/89. Attendance: 37.

Burnside, W. D., Ohio State University, Columbus, OH, "Compact Ranges and RCS Measurement Techniques," 2/1/90. Attendance: 77.

Burnside, W. D., Ohio State University, Columbus, OH, "Compact Ranges and RCS Measurement Techniques," 2/8/90. Attendance: 34.

SOUTHEASTERN MICHIGAN (MTT/AP/ED)

IEEE Video Tape, "Applications of High Temperature Superconductivity," 11/8/88. Attendance: 20.

Liepa, Val, Univ. of Michigan, Ann Arbor, MI, "Corrugated Horns, Optical Fibers and Dielectric Cones — the Hybrid Feed — Past, Present and Future," 11/10/88. Attendance: 50+.

Tai, C. T., Michigan State University, E. Lansing, MI, "Systematic Treatment of Vector Analysis," 2/9/89. Attendance: 50+.

Steinberg, Bernard D., Univ. of Michigan, Ann Arbor, MI, "High Resolution Microwave Imaging," 2/22/89. Attendance: 50+.

Lattaie, Ivan J., Michigan State University, E. Lansing, MI, "Synthetic Aperture Radar Signature Simulation," 3/30/89. Attendance: 30.

SPAIN (MTT/AP)

Caceres, Jose, ETSI Telecomunicacion, Ciudad Universitaria, Madrid, Spain, "Submicron GaAs MESFETs: Design and Technology," 11/15/89. Attendance: 18.

Catedra, M. F., ETSI Telecomunicacion, Madrid, Spain, "Application of Conjugate Gradient Method in Electromagnetics and Signal Processing," 12/18/89. Attendance: 19.

SWEDEN (MTT/AP)

Rengarajan, S. R., California State University, Northridge, CA, "Recent Work on Coupling and Radiating Slots in Rectangular Waveguides," 8/23/89. Attendance: 14.

Hagtors, Tor, Cornell Univ., Ithaca, NY, "The Upgrading of the Arecibo Telescope — A Progress Report," 10/4/89. Attendance: 18.

Sarkar, Tapan K., Syracuse University, Syracuse, NY, "Scattering from Composite, Conducting and Dielectric Structures, Including Finite Microstrip Antennas," 11/23/89. Attendance: 10.

Arcioni, Paolo, Universita di Pavia, Pavia, Italy, "Analysis of Planar Circuits," 2/19/90. Attendance: 19.

Johansson, Joakim, Jet Propulsion Laboratory, Pasadena, CA, "Design and Analysis of 34m Beam Waveguide Antenna," 5/25/90. Attendance: 10.

SYRACUSE (MTT/AP)

Schwering, Felix, U.S. Army CECOM, Fort Monmouth, NJ, "Millimeter Wave Antennas," 5/25/89.

Crane, Robert, Dartmouth College, "The Effects of Rain on Radar Systems," 6/21/89.

Healy, Greg, COMDEV, Cambridge, Ontario, Canada, "Millimeter Wave Downconverters," 11/16/89. Attendance: 19.

TAIWAN (MTT)

Sun, Cheng, California State University, St. Louis Obispo, CA, "Millimeter Wave Devices, Circuits and Systems," 7/1/89. Attendance: 100.

Chang, D. T., Chung Shang Inst. of Science and Technology, Chung Li, Taiwan, "On Antenna Design and Analysis," 8/6/89. Attendance: 100.

Levien, Fred, The Levien Group of USA, Los Altos, CA, "Space Technology and NASA," 12/11/89. Attendance: 50.

Levien, Fred, The Levien Group of USA, Los Altos, CA, "Satellite Roles in Today's World," 12/12/89. Attendance: 60.

Levien, Fred, The Levien Group of USA, Los Altos, CA, "Electronic Warfare," 12/15/89. Attendance: 70.

TOKYO (MTT)

Yamashita, E., "1988 Asia Pacific Microwave Conference Report"; Mizuno, K., "13th International conference on Infrared and Millimeter Waves," 2/17/89. Attendance: 29.

Sad, Theodore, "The History of MIT Radiation Laboratory"; Kobayashi, Yoshio, "Dielectric Resonators and its application to Compact Filters," 4/13/89. Attendance: 38.

Yoneyama, Tsukasa, Tohoku University, Katahira Sendai-City Miyagi-Pref., Japan, "Basic Theory of Transmission Lines," 7/14/89. Attendance: 71.

Yoneyama, Tsukasa, Tohoku University, Katahira Sendai-City Miyagi-Pref., Japan, "Basic Theory of Transmission Lines," 7/27/89. Attendance: 75.

Yoneyama, Tsukasa, Tohoku University, Katahira Sendai-City Miyagi-Pref., Japan, "Basic Theory of Transmission Lines," 7/28/89. Attendance: 62.

Cardiol, F.E., Ecole Polytechnique Fédérale, "Computer-Aided Analysis of Microstrip Circuits: The Integral Equation Approach," 8/18/89. Attendance: 18.

Cardiol, F.E., Ecole Polytechnique Fédérale, "Computer-Aided Analysis of Microstrip Circuits: The Integral Equation Approach," 9/5/89. Attendance: 42.

Tsutsumi, Makoto, and 5 other members, "Report from 1989 MTT-S International Microwave Symposium," 9/21/89. Attendance: 22.

Ogawa, Hiroya, and Ohira, Fumikazu (NTT), "A Report on the 1989 MTT-S International Symposium Workshop," 10/20/89. Attendance: 35.

Akaike, M. (ATR), and 7 other members, "1989 European Microwave Conference Report," 10/22/89. Attendance: 44.

Ohata, K. (NEC), and 2 members, "1989 European Microwave Conference Workshop Report," 12/22/89. Attendance: 44.

Rosenbaum, F. J., Washington University, St. Louis, MO, "Trends in the Microwave Academy and Industry," 1/22/90. Attendance: 30.

Rosenbaum, F. J., Washington University, St. Louis, MO, "Trends in the Microwave Academy and Industry," 1/22/90. Attendance: 30.

Rosenbaum, F. J., Washington University, St. Louis, MO, "Simulating the Nonlinear Operation of Large-Signal Microwave Circuits," 1/23/90. Attendance: 126.

Rosenbaum, F. J., Washington University, St. Louis, MO, "Simulating the Nonlinear Operation of Large-Signal Microwave Circuits," 1/26/90. Attendance: 45.

UNITED KINGDOM/IRELAND (MTT/ED)

Clarricoats, P. J. B., Queen Mary College, Univ. of London, London, England, "Satellite System and the Optical Fiber Challenge — A European View," 3/9/88. Attendance: 40.

VENEZUELA (MTT/COM)

Bianchi, Aldo, Carabobo University, Valencia, Venezuela, "Microwaves: Fifteen Years of Work at Carabobo University," 2/4/88. Attendance: 135.

Rabinovich, Pedro, ITM Communications, Maracay, Venezuela, "Modern Communications," 3/8/88. Attendance: 20.

Bianchi, Aldo, Carabobo University, Valencia, Venezuela, "Advances in Fiber Optics," 6/28/88. Attendance: 22.

Bianchi, Aldo, Carabobo University, Valencia, Venezuela, "TVRO — A Reality," 11/22/88. Attendance: 24.

Bianchi, Aldo, Carabobo University, Valencia, Venezuela, "Fiber Optics — A Technology for the End of the Century," 1/30/89. Attendance: 21.

Bianchi, Aldo, Carabobo University, Valencia, Venezuela, "Communications — A Nervous System of the Society," 2/22/89. Attendance: 27.

Rabinovich, Pedro, ITM Communications, Maracay, Venezuela, "Communications at Work — ITM Company," 6/14/89. Attendance: 11.

Bianchi, Aldo, Carabobo University, Valencia, Venezuela, "Communications — A Fast Growing Field in Electrical Engineering," 9/14/89. Attendance: 31.

Video tape: "Communications Technology/TDR, Submarine Cable, INTELSAT, RVRO," Hewlett Packard, Intelsat, 3/19/90. Attendance: 18.

Video tape: "Communications Technology: Antenna TVRO-INTELSAT-RADAR," INTELSAT, 3/26/90. Attendance: 18.

Alvarez, A., ROYALSAT, "Starting a Communications Company: A Real Life Experience," 4/4/90. Attendance: 31.

Video tape: "IEEE/Join the IEEE/INTELSAT," IEEE/INTELSAT; Marquez, J., University of Carabobo, "UNIX, Multiuser Operating System," 6/6/90. Attendance: 50.

Video tape: "Join the IEEE," IEEE; Rodriguez, E., University of Carabobo, "Digital Radio Links," 6/7/90. Attendance: 20.

Bianchi, A., University of Carabobo, "Communications, a Fast Developing Field," 6/13/90. Attendance: 40.

VIRGINIA MOUNTAIN (MTT/ED)

Trew, Robert, NC State University, Raleigh, NC, "Modeling of Solid State Devices," 1/18/89. Attendance: 26.

Riad, Sedki M., Virginia Polytechnic Institute, Blacksburg, VA, "Overview of Time Domain Techniques," 11/30/89. Attendance: 14.

Shur, Michael, University of Virginia, Charlottesville, VA, "New Continuous Heterostructure Field Effect Transistor Model and Unified Parameter Extraction Technique," 2/2/90. Attendance: 18.

WASHINGTON/NORTHERN VIRGINIA (MTT)

Brookner, Eli, Raytheon Co., Wayland, MA, "Aspects of Modern Radar; Radar Systems Overview," 10/10/89. Attendance: 45.

Howard, Dean, Locus, Inc., Alexandria, VA, "Monopulse Radar (Aspects of Modern Radar lecture series)," 11/14/89. Attendance: 35.

Schrank, H., Westinghouse Electric Co., Baltimore, MD, "Low Sidelobe Phased Array Antennas," 1/9/90. Attendance: 41.

Trunk, Gerard, Naval Research Laboratory, Washington, DC, "Aspects of Modern Radar Series: Radar Cross Section," 2/13/90. Attendance: 67.

Leighton, D., Raytheon Co., Wayland, MA, "Aspects of Modern Radar: MMIC," 3/13/90. Attendance: 51.

Brown, Charles, GTRI, Atlanta, GA, "Aspects of Modern Radar Series: MMW Radar," 4/10/90. Attendance: 52.

WEST GERMANY (MTT/AP)

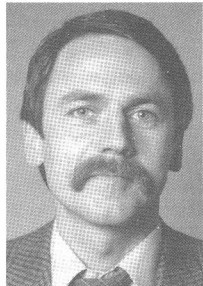
Spirito, Paolo, Università di Napoli, Napoli, Italy, "The Bipolar Mode of Field Effect Structures: Theory of Operation and Modeling," 7/12/88. Attendance: 35.

YUGOSLAVIA (MTT)

Itoh, Tatsuo, Univ. of Texas, Austin, TX, "Recent Trends in Quasi-Optical Planar Integrated Circuits and Components," 9/21/89. Attendance: 50.

Palmateer, Lauren, Cornell University, Ithaca, NY / Ecole Normale Supérieure, Paris, France, "High Performance AlAs/GaAs Modulation Doped Field Effect Transistors," 12/21/89. Attendance: 27.

Region 8 MTT Chapter News



by Rolf H. Jansen
Transnational Committee, MTT Society
Region 8 Chapter Coordinator

Region 8 Chapter Activities and Workshops in 1989 and Early 1990

As an information to be transmitted to MTT members on a regular basis in the future, we are starting in this issue to communicate brief summaries of recent technical activities and workshops, and of such coming very soon to the whole MTT membership. We shall try at the same time to announce Chapter Workshops and symposia, which are more than 3 months ahead in the Region 8 Newsletter. In the present issue, events are briefly summarized that were conducted in France, Israel, South Africa, Sweden, Switzerland, United Kingdom/Ireland, West Germany and Yugoslavia. Please contact the respective Chapter Chairpersons if you would like to have more information or the digest of a specific workshop.

France, Chairman Dr. V. Fouad Hanna, CNET, Paris

Three meetings were conducted by the French Chapter in 1989, namely:

1. February 1989 with a contribution by Prof. Itoh entitled "Integrated Millimeter Wave Components using Quasi-Optical Design Combined with Planar Structures."
2. May 1989 with a talk by Prof. R. Sorrentino, II, University Degli Studi, Rome, on "Modeling of Microwave and Millimeter Wave Passive Components." In this meeting also the video tape by the past Distinguished Lecturer E. C. Niehenke on "Gallium Arsenide Key to Modern Microwave Technology" was presented to the audience.
3. The MTT-S France Chapter organized a workshop on "CAD of Microwave Circuits and Planar Antennas" that was held on November 23 and 24, 1989, at Poigny-la-Forêt, which is a small village that lies in the surrounding forests of Paris. An important number of participants of 71 people was registered (and many demands for participation were not accepted due to space restrictions). There were 23 participants from government agencies, 31 participants from universities, and 14 participants from private industries. The two French industrial companies engaged in microwave CAD: CAROLINE and RACAL-REDAC were also presented. The number of speakers was 36. The topics treated in the workshop were: electric or electromagnetic models for active or passive microwave components circuit synthesis, optimization or simulation general-purpose CAD programs, equivalent circuit extraction techniques and drawing CAD programs.

Ample time was given for discussions in a relaxed and informal atmosphere. The discussions had demonstrated the importance of the treated subjects in regard of the development of microwave and millimeter, linear and nonlinear, MMICs especially for planar antennas applications. The assembly advised to discuss the possibility of cooperation and exchange of information with the MTT-S

German and United Kingdom Chapters that have already organized similar workshops during the precedent three months. The assembly recommended also the creation of a club that assembles the designers and the users of nonlinear CAD programs.

The workshop had also demonstrated the shortage of commercial intermediates whose main task must be the development, for an easier use, of complex CAD programs elaborated by theoreticians.

Israel, Chairman Dr. A. Saad, Haifa

As usual, the Israel Chapter conducted a large annual meeting that took place in December 1989 in Herzlia, Israel. This 12th Symposium of the Israeli joint MTT-AP Chapters was organized by Dr. Eli Levine and Dr. A. Saad (part of the proceedings is in English, part of it in Hebrew).

Further details have been described by Dr. Saad as follows:

The two-day conference was planned to emphasize the possible outcomes of the new era, which predicts severe cutbacks in defense budget, that might implicate the future of our technical group, due to the fact that part of it is fed from military applications. To indicate possible alternative activities, we decided the opening lecture of the first day as well as the full second day to this topic.

In the first day we mostly dealt with technical and scientific subjects in the line of interest of the chapter. 17 articles were presented, one of which was dedicated to commemorate the late Prof. M. Kisseliuk of Tel-Aviv University, and a special session of four technical lectures to commemorate Shimon Caspi, who was also a known active figure in the microwave community in Israel.

In the second day we ran a workshop on civil applications of microwaves and antennae. There were invited lectures on industrial, medical, domestic, civil-communication and car-industry applications, as well as communication satellites. Lecturers were either manufacturers of equipment to the civil market or potential clients. The day ended by a panel discussion that reflected high motivation of the technical people to gear their activities to the requirement of the civil market.

Sweden, Chairman Dr. T. Lewin, Ericsson Radar Electronics, Molndal

The Swedish Chapter has its activities on a monthly basis in the form of meetings or one day Symposia. The titles of the Symposia or individual presentations conducted are listed in the following:

1. March 1989 — One-day Symposium on High Power Microwaves and Stealth Technique
 - Mr. K. Madsen, Swedish Defense Research Establishment, Linköping, "Is HPM of interest for Swedish defense?"
 - Dr. L. Lundgren, Chalmers Univ. Tech., Göteborg, "High power valves."
 - Mr. E. Witalis, Swedish Defense Research Establishment, Stockholm, "Power sources for HPM."
 - Mr. M. Backstrom, Saab-Scania, Linköping, "HPM activities at Saab Aerospace."
 - Mr. J-O Ousback, Swedish Defense Research Establishment, Linköping, "Stealth technique."
 - Mr. A. Bergvist, Swedish Defense Research Establishment, Linköping, "Absorbing material."
 - Mr. J. Melin, Saab-Scania Missiles, Linköping, "Activities on radar target scattering at Saab Missiles."
2. April 1989
 - Dr. R. H. Knerr, MTT Distinguished Lecturer, AT&T Bell Laboratories, Breinigsville, PA 18031, U.S.A., "Lightwave Communications."

3. May 1989

- Prof. P. B. Katehi, Univ. of Michigan, Ann Arbor, MI U.S.A., "Problems in microstrip and slot antennas."

4. June 1989 — One-day Colloquium Highlighting FEM Methods as Applied to EM Field Problems, with contributions as follows:

- Prof. En Schanda, MIT Distinguished Lecturer, Univ. Bern, Switzerland, "Remote sensing with microwave and millimeter waves."
- Dr. Peter Linner, Chalmers, "Introduction — CAD in networks and EM fields."
- Dr. Petra Schutt, Technische Hochschule Darmstadt, W. Germany, "2D and 3D Electromagnetic Field Computation with TCBI, URMEI, URMEI-T, and MAFIA."
- Mr. Michael Benda, Chalmers, "A non-linear method for ideal MHD."
- Prof. Claes Johnson, Chalmers, "Mathematic aspects of FEM for electro-magnetic problems."
- Prof. Staffan Strom, Royal Inst. Tech., Stockholm, "On the use of global expansion functions in EM scattering in 3 dimensions — focus on the null-field approach."
- Dr. Stefan Toader, ABB Corporate Research, Vasteras, "Ace — a numerical laboratory," "Applications of FEM in power electrotechniques."
- Dr. Thomas Ericsson, Chalmers, "Basic properties of two linear algebra problems."
- Mr. Jan Svedin, Nat. Def. Research, Linkoping, "A numerically efficient finite element formulation without spurious modes for general waveguide problems."
- Mr. Mats Backstrom, Saab-Scania Aerospace, Linkoping, "EMI analysis using FDM for solving Maxwell's equations in the time domain."

5. August 1989

- Prof. S. R. Rengarajan, California State Univ., Northridge, U.S.A., "Recent work on coupling and radiating slots in rectangular waveguides."

6. October 1989

- Prof. Tor Hagfors, Cornell University, Ithaca, NY, U.S.A., "The upgrading of the Arecibo telescope, a progress report."

7. November 1989

- Prof. T. K. Sarkar, Syracuse Univ., NY, U.S.A., "Scattering from composite conducting and dielectric structures, including finite microstrip antennas."
- Mini-Symposium on Active Microwave and Millimeter-wave Components, with the three presentations given here:
Dr. Heinrich Daembkes, AEG Research Center, Ulm, Vastyskland, "Microwave and Millimeter Wave HEMT Devices and Circuits" (IEEE Microwave Lecturer, Biography and abstract is enclosed).
Dr. Herbert Zirath, Chalmers University of Technology, Goteborg, "HEMT Activities at Chalmers."
Dr. Magnus Willander, Linkoping University, "Silicon Based Microwave Heterostructure Devices."

South Africa, Chairman C. W. Pistorius, University of Stellenbosch

Chapter activities in South Africa have been organized essentially by a team of members located in the EE Department of the University of Stellenbosch. The activities were in the form of a microwave evening, a colloquium and a series of seminars. In more detail, the respective events were:

1. June 1989 — Western Cape Microwave Evening, with 4 twenty-minute presentations, namely:
 - "Low loss power combiners," Johan Gericke, Plessey.
 - "Superconductors: microwave applications," W. J. Perold, U.S.

- "Intermodulation distortion in mixers," P. J. Wolfaardt, E.S.D.
- "Microwave ore sorting in diamond mines," B. J. Downing, U.C.T.

2. July 1989 — A Colloquium on Microwave Super Sources — Present Status and Future Prospects, in Durban at the EE Department of the University of Natal. The objective was to bring together those active or involved in the design of microwave power systems, with the program summarized here:

- "Vacuum tubes: current status and future prospects," JRM Vaughan, Litton Tubes; "Solid state: present systems power capabilities," P. W. Smit, ESD South.
- "Microwave amplifiers: device choice," P. W. van der Walt, University of Stellenbosch; "Vacuum device reliability," J. R. M. Vaughan, Litton Tubes; "Solid state: technological and theoretical limits," A. Botha, Materials Research, CSIR.
- "Ultra high power devices: fast wave devices," J. R. M. Vaughan, Litton Tubes; "Novel designs and structures," E. W. Schumann, University of Natal.

3. A series of seminars on Microwave Integrated Circuit Design was held on Tuesday starting in July 1989.

Switzerland, Chairman Prof. A. C. Bauder, ETH Zurich

The key event in the Swiss Chapter was a full-day Symposium at the Physical Chemistry Laboratory of the Zurich Federal Institute of Technology in October 1989 on the topic: **Microwaves in Spectroscopy and Frequency Standards.**

Dr. Arthur Schwinger presented the basic principles of electron spin resonance (ESR) spectroscopy, a powerful technique to analyze paramagnetic matter in the solid, liquid, and gaseous states. This technique uses microwaves to flip over electron spins placed in a static magnetic field. It is extensively applied in physics, chemistry, biology, medicine, environmental and material sciences. The two regimes of continuous and pulsed irradiation were presented and illustrated by an actual experiment of electron spin echo.

Professor Alfred Bauder then outlined the microwave spectroscopy of rotating molecules. Short microwave pulses, from 20 ns to 5 μ s duration, polarize the molecules. At the end of the exciting pulse, the polarized molecules radiate signals at their characteristic frequencies, which are amplified, down converted and Fourier transformed. Since the detected signals are very weak, particular precautions are required to avoid noise. Two spectrometers were designed, using a waveguide Stark cavity and a Fabry Perot resonator.

Professor Giovanni Busca, director of the Neuchatel Observatory, presented and compared the three most accurate frequency standards presently in use, based on the transitions in hydrogen, rubidium and cesium. The typical bandwidths of these transitions are of the order of a few Hertz, at microwave frequencies, which poses some particularly interesting stability problems for microwave engineers.

The technical presentations were followed by a visit of the Physical Chemistry Laboratory, where all the participants could see the apparatus in which the techniques described in the technical presentations are implemented.

The program of this workshop involved the following presentations:

- "Electron Spin Resonance Spectroscopy," A. Schweiger, Lab. fur Phys. Chem. ETHZ.
- "Microwave Spectroscopy of Rotating Molecules," A. Bauder, Lab. fur Phys. Chem. ETHZ.

- "Microwave Techniques in Frequency Standards," G. Busca, Observatoire de Neuchatel.
- Demonstrations of four different new spectrometers and measurement cells (Microwave Cavities).

United Kingdom/Ireland, Chairman I. Williamson, M/A-Com.

The UK/RI Chapter organized the MTT-membership booth at the European Microwave Conference, from which they received 20 new membership applications. They also organized the MTT-Chapter Chairman's Meeting on Wednesday, September 6, 1989, at which there were 20 people present.

Two meetings were conducted in 1989:

1. January 1989, with a presentation by Prof. R. H. Jansen on "CAD of Hybrid and Monolithic Microwave & MM-Wave MICs," Jansen Microwave.
2. April 1989, with a talk by Prof. F. E. Gardiol on "Microstrip Circuit Analysis: The Integral Approach," Ecole Polytechnique Federal de Lausanne.

West Germany, Chairman Prof. Dr. H. L. Hartnagel, Technische Hochschule Darmstadt, Darmstadt

The West German Chapter initiated a number of Workshops in the time between October 1989 and April 1990, which are briefly described here. A further series of Workshops will start in Oct. 1990 and will be announced soon.

1. October 1989 — A workshop on "Progress in Microwave CAD and in CAD Applications," under sponsorship by Hewlett-Packard, Ratingen:

The fourth edition of the West Germany MTT/AP Chapter Workshop on Microwave CAD and related topics was held at the Vertriebszentrum West of Hewlett Packard Company, Ratingen, West Germany, on October 26 and 27, 1989, with international participation. This workshop reported on and identified progress in microwave CAD and presentations given came both from authors engaged in the development of CAD tools and from industry CAD users. There was ample time for discussions in a relaxed and informal atmosphere. Due to space restrictions, the number of workshop participants was limited, but the workshop was still conducted with 85 participants. Actually, it was overbooked and, encouraged by the response, we are considering to organize a twice as larger workshop at Ratingen in about two years. A social program and an MTT/AP Chapter meeting accompanied the workshop. The atmosphere at the workshop was great, the technical program was interesting and accompanied by vivid and engaged discussions. The following is a list of the presentations given at the workshop:

- M. Odyneic, Hewlett-Packard, Santa Rosa, U.S.A., "Breakthrough in Nonlinear Simulation."
- M. I. Sobhy, University of Kent, Canterbury, England, "The Application of Parallel Processing in Analysing and Designing Microwave Networks."
- W. H. Childs, EEsof, Inc., Westlake Village, U.S.A., "Integrated CAD for Modern Microwave Design."
- U. L. Rohde, Compact Software, Inc., Paterson, U.S.A., "MMIC Foundry Models Using Standard CAD Simulators."
- J.-E. Muller, Siemens AG, Munich, West Germany, "Investigation of GaAs MESFET Small Signal Equivalent Circuits for Use in a Cell Library."
- J. W. Bandler, Optimization Systems Associates Inc., Dundas, Canada, "Statistical Design, Yield Optimization and Device Modeling for (M)MICs."
- R. H. Jansen, Plessey Research Caswell, Ltd., Caswell, England, "Progress in Passive and Active MMIC Device

Modeling."

- F. Myers, Plessey Research Ltd., Caswell, England, "Advanced GaAs MMIC Elements and Circuits."
 - B. Adelseck, AEG AG, Ulm, West Germany, "Application of CAD Software to the Design of Planar Millimetre Wave Circuits."
 - A. Beyer, University of Duisburg, Duisburg, West Germany, "An Improved Method for the Design and Simulation of Integrated Microwave Oscillators."
2. December 1989: A Workshop on Millimeterwave Semiconductors took place at the Technical University Munich. This Workshop has been organized at the Lehrstuhl für Hochfrequenztechnik (Institute for High Frequency Engineering). Within this Workshop the following six technical papers were presented:
 - Prof. Dr. G. Weimann, Walter-Schottky-Institut, Technische Universität München, "Molecular Beam Epitaxy for Modern Devices."
 - Dr. H. Dambkes, Daimler-Benz Research Institute, Ulm, "GaAs HEMTs."
 - Dr. L. Treitinger, Research Center of the Siemens AG, Munich, "Silicon Homo- and Hetero-Bipolar Transistors for Microwave and Millimeterwave Applications."
 - Dr. J. F. Luy, Daimler-Benz Research Institute, Ulm, "Technology of Silicon Millimeterwave Devices."
 - Dr. H. Eisele, Lehrstuhl für Allgemeine Elektrotechnik und Angewandte Elektronik, Technische Universität München, "Fabrication and Characterization of GaAs Avalanche Transit Time Diodes."
 - Dr. J. Buchler, Lehrstuhl für Hochfrequenztechnik, Technische Universität München, "Integrated Silicon Millimeterwave Devices."

Each contribution was given an excellent overview over the treated topic. The presentations had a length of 40 minutes, including discussion. The presentations were accompanied by interesting discussions between the participants of the workshop. Workshop volume with copies of the view graphs has been issued.

3. February 1990: A workshop on Microwave Components and Subsystems was held at Schloß Reisenburg near Ulm, West Germany. The Workshop presented state-of-the-art and current work on microwave and millimeterwave components and subsystems. In addition to the fixed program, participants were encouraged to present their own work in a few minutes talk.

The following presentations were given at this Workshop:

- T. Oxley, formerly GEC Research, "mm-Wave Microstrip Components."
- H. Meinel, Telefunken Systemtechnik, "mm-Wave Technology."
- J.-F. Luy, J. Buchler, K. M. Strohm, U. Guttich, Daimler-Benz Research Institute/Telefunken Systemtechnik, "Coplanar Integrated mm-Wave IMPATT Oscillators."
- J. Freyer, TU München, "MMIC-Resonator on Si GaAs for V-Band Frequency."
- J. Detlefsen, TU München, "PW-Code mm-Wave Radar."
- T. Itoh, University of Texas, Austin, "Active Microwave Filters."
- Chapter Meeting (MMT/AP members only).
- D. Pons, P. Briere, Thomson CSF, Central Research Labs, "Innovative Technologies for Future MMICs."
- K. Solbach, H. P. Feldle, Telefunken Systemtechnik, "Phased Array Technology."
- A. M. Khilla, ANT, "Solid State Power Amplifiers for Space Applications."
- H. Chaloupka, University of Wuppertal, "Application of High-T_c Supra-conductors for Microwave Components."

4. April 1990: About the time of the distribution of this newsletter a Workshop on Measurement Techniques for Microwave Device Characterization and Modelling will be held at Stuttgart, West Germany, jointly with the MIOP 1990, Microwave and Optronics Conference (Monday, April 23, 1990).

The intention of the workshop is to review the state of the art of measurement techniques for the characterization and modelling of microwave devices. The workshop will cover different important topics, including instrumentation calibration methods and verification tests in coaxial, conventional microstrip and monolithic medium, error-correction of device S-parameters, model parameter extraction algorithms, model parameter consistency, physically correlated model topologies, small- and large-signal characterization, noise characterization, and advanced contactless optical characterization methods.

The Workshop program includes the following contributions:

- M. Martin, Hahn-Meitner-Institut, Berlin, FRG, "S-Parameter Measurements in the Microstrip Environment — the Hard Way."
- J. Curran, Hewlett-Packard, Santa Rosa, U.S.A., "Microstrip Device In-Fixture Measurement with Modern Network Analyzers."
- H.-J. Eul, University of Bochum, FRG, "Generalized Calibration Procedure for Network Analyzer Calibration and Verification."
- R. L. Vaitkus, Motorola, Tempe, U.S.A., "Alternatives to Optimizer-Based Methods for Microwave Device Small-Signal Equivalent Circuit Parameters."
- A. L. Scholtz, Technical University of Vienna, Austria, "Nonlinear Model Parameter Extraction for HBTs based on S-Parameter Measurement."
- G. Kompa, University of Kassel, FRG, "Small- and Large-Signal Characterization Methods, Modelling and Verification."
- E. W. Strid, Cascade Microtech, Beaverton, Oregon, U.S.A., "On-Wafer Calibration, Device Measurement and Modelling."
- D. M. Brookbanks, Plessey, U.K., "Measurements and Modelling of High Performance MESFET and HEMT Devices."
- M. Berroth, Fraunhofer Institute for Applied Solid State Physics, Freiburg, FRG, "High Frequency Equivalent Circuits of GaAs FETs for Large Signal Applications."
- A. Cappy, G. Dambrine, University of Lille, France, "Determination of the Device Noise Parameters."
- J. Kuhl, Max-Planck-Institut for Solid State Research, Stuttgart, FRG, "Contactless Optical Device Characterization Methods with Picosecond Laser Pulses."

Yugoslavia, Chairman Branka Jokanovic, IMTEL — Institute of Microwave Techniques and Electronics, Beograd

A brief description of the Yugoslav Chapter in 1989 was transmitted to us by the Chairman and reads as follows:

Yugoslav MTT Chapter has been established in June 26, 1989. We had started with 19 members and at the end of the last year we had 40 members. During the last few months we were trying to inform microwave engineers from other Yugoslav University centers (Novi Sad, Nis, Sarajevo and Banja Luka) about the new MTT chapter, send them application forms and pamphlets, and invited them to join us in MTT society.

We also organized two technical meetings in the Institute of Applied Physics at September 21, 1989, and December 21, 1989.

1. Our first guest was Prof. Tatsuo Itoh from University of Texas (University of Texas, Electrical Engineering Research Laboratory, Engineering Science Building, Austin, Texas 78712-1084, U.S.A.). Prof. Itoh gave two lectures entitled:

- a) "Recent Trends of Quasi Optical Planar Integrated Circuits and Components"
- b) "Research on Microwave Optical Interaction at the University of Texas."

About 50 people from different Yugoslav University centers were present there. It was an excellent presentation of quasi optical mixers including comparison between quasi-optical and classical mixers, design considerations, historical review and recent contribution to quasi optical mixers. We also find very useful Prof. Itoh's lecture concerning research on Microwave Optical Interaction at the University of Texas.

It was the nice opportunity to get informed about the new and imaginative solution such as coupled slot antenna and receiver, self oscillating mixer, a polarization-duplexed quasi-optical transistor amplifier, single and balanced transceiver circuits, integrated leaky-wave resonator antenna and Schottky-biased optically controlled coplanar waveguide phase shifter.

2. At December 21, 1989, our guest was Dr. Lauren Palmateer (Cornell University, U.S.A./Ecole Normale Supérieure, Paris, and Thomson CSF-LCR, France). The address for eventual contacts is: Radioastronomie Millimetrique-Ecole Normale Supérieure, 24 Rue Lhomond 75231 PARIS CEDEX 05, Tel.: 33-1-43291225; fax: 33-1-4587 3489.

Dr. Palmateer gave the lecture entitled "High Performance AlInAs/GaInAs Modulation Doped Field Effect Transistors." DC and RF device characterization at high performance 0.2 μm gate length AlInAs/GaInAs/InP MODFETs was presented as well as the achieved unity current gain cutoff frequencies of 100-120 GHz and maximum frequencies of oscillation in excess of 180 GHz. Also, the transport phenomena affecting the performance of the MODFETs were discussed. The presented results were the subject of her Ph.D. thesis entitled "DC and RF Characterization of GaInAs/AlInAs/InP Modulation Doped Field Effects Transistors for Millimeter Wave Devices Applications" (Faculty of the Graduate School of Cornell University, May 1989).

Dr. Palmateer also informed us about her current researches on a project using quantum well resonant tunneled structures for local oscillator sources in radioastronomy receivers.

About 25 people were present there and we had a very interesting discussion about both topics.

Yugoslavia Activities and Plans for 1990

1. We have started our activities on organizing the First International Scientific Meeting "Microwaves in Medicine '91." We plan this meeting for April 8-11, 1991, in Belgrade.

During the last three years we organized Yugoslav meetings on Microwave Radiation Protection in the Institute of Applied Physics (now IMTEL-Institute of Microwave Techniques and Electronics) but we have no experience in organizing such international meeting. So I send you the preliminary ANNOUNCEMENT AND CALL FOR PAPERS and I would appreciate your suggestions about it. I think it would be nice to announce our meeting in the Region 8 Newsletter if it is possible.

Region 8 MTT Chapter News (cont. from previous page)

2. We would be happy to have you, Prof. Jansen, as our lecturer in June this year. We think that the lecture entitled "Full Wave Analysis and Modelling for CAD of Millimeter Wave MMICs" would be very useful for all of us. So I hope that there would be an opportunity to meet you at MIOP '90 and talk about your visit to Belgrade as well as to discuss the Yugoslav MTT Chapter activities.
3. For October this year we plan to present recent developments on microwave filters and filters multiplexers with special accent on suspended stripline structures. This meeting will be for Yugoslav attendants and will be held at the Institute of Applied Physics and at the Faculty of Electrical Engineering in Belgrade.

In addition the Yugoslav Chapter has started activities on organizing the 1st International Scientific Meeting "Microwave in Medicine 1991." We shall try to announce details of this in the Region 8 Newsletter together with other planned activities with the Yugoslav Chapter.



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Guest Editor's Comments

(cont. from page 4)

What's in this issue?

It appears to me after reading the technical articles in this Newsletter and in the previous issue that new technology is truly emerging for use in our high-speed and microwave/millimeter-wave oriented industries. Read that as: We ain't dead yet! Our feature article by Dick Snyder emphasizes the impact of three technological developments on filter design: desktop computers, active implementations of circuitry previously using passive circuits, and superconductivity. The article by James Rautio reinforced my beliefs as he summarized the change of the 80's to the 90's for microwave design. The 80's designs were previously based on circuit theory and in the 90's are rapidly incorporating an electromagnetic design base. What a twist! All of us so-called "microwave engineers" studied EM fields, entered the industry, promptly forgot B X H, and used circuit theory to design amplifiers, mixers, or whatever. Now we are back to serious use of EM theory and applications again! Or almost. Fantastic. I knew there was a reason I stayed up all night applying Maxwell's equations in school. Never give up, that's one of my mottos.

Barry Perlman edited an article by Magdy Iskander which reflects on an exciting opportunity to make a difference in electromagnetics education. This article describes a National Science Foundation supported project called Computer Applications in Electromagnetics Education (CAEME). CAEME technical activities include development of a software catalog, sponsorship of special sessions and workshops in international symposia, and the publication of books that include diskettes of educational software. This is truly an exciting initiative to EM education. Our education institutions need this project and I am glad someone has taken charge.

Another emerging use of our technology is by the medical industry. Things seem to have progressed quite well according to Arye Rosen in his article on "Microwave Applications in Cancer Therapy, Cardiology, and Measurements Techniques: A Short Overview." Arye shows examples where microwaves have been used successfully in the areas of diagnostic and therapeutic medicine.

The article by K. Slegler, R. Abrams, Jr., and R. Parker presents "Trends in Solid-State Microwave and Millimeter-Wave Technology." They offer several answers to the all-important question for the solid-state components community — "What lies beyond the rapidly-changing microwave technologies in silicon, GaAs, or InP?"

Quite a bit has happened this year in intersocietal relations and Transnational Activities. Two of the three 1990 IEEE TAB meetings are reported by three different authors and articles. I kept them all in this Newsletter because each had a different perspective and I learned something from all three about TAB and its progress toward administering technical activities. Region 8 activity is approaching critical mass according to what I read from Rolf Jansen. I can hardly wait to see what happens to Eastern Europe IEEE and MTT-S activity due to the wipeout of the "cold war."

Well, someone is knocking at my door. I need to get back to my "real job." However, one more byte of commentary. Thanks to all the IEEE MTT-S volunteers whom I have observed assisting our Society since I became an active Member in 1979. Also, I hope the first and last Newsletter issue I was involved in provided service to you. If not, please get involved and help make our Society better. Now about that real job . . .

3rd International Symposium on Recent Advances in Microwave Technology (ISRAMT '91)

CALL FOR PAPERS

The 3rd International Symposium on Recent Advances in Microwave Technology (ISRAMT '91) sponsored by the University of Nevada, Reno, and IEEE Northern Nevada Section, is scheduled from May 22-25, 1991, in Reno, Nevada, U.S.A. The symposium will cover all the topics in Microwave Technology & Its Applications including Components & Circuits, Antenna & Radar, MICs & mm-ICs, Remote Sensing, Biological Effects & Other Applications, Communication Systems, CAD Techniques, Propagation & Measurements, Electro-Optics, Microwave/mm-wave Optical Technology, Microwave Superconductivity and Microwave Education.

Exhibits of Industrial Products and Workshops are also planned. One original and 3 copies of the 4-page manuscript prepared according to the instructions (sent on request) are required by January 15, 1991. The working language of the symposium will be English. For additional information regarding manuscripts, industrial exhibits and workshops, please contact:

Banmali Rawat, Chairman
Technical Program Committee
Electrical Engineering and Computer Science Department
University of Nevada, Reno
Reno, NV 89557-0030 U.S.A.
Telephone: (702) 784-6927
Fax: (702) 784-1300



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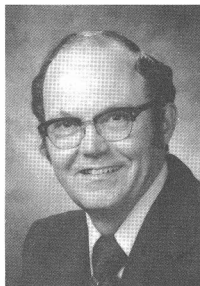
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PCs for ~~AP~~ MTT August 1990



by E. K. Miller

Help!!! Information Overload!!!!

This year's meeting at Dallas in early May was another landmark event, especially combining as it did the usual AP-S and URSI symposia, as well as the MTT-S symposium and as an extra bonus the two-day Monolithic Circuits Symposium. Consequently, there were an unprecedented number of events from which to select, at least compared with the usual AP-S/URSI Symposium. These included up to 13 AP-S/URSI sessions, an additional four from MTT-S, and the single-session Monolithic symposium. In addition, there were the dozens of exhibitors that are now a standard feature at MTT meetings.

The result was that it was not easy choosing sessions and presentations to attend. I wonder how those of you who participated in this year's meeting handled that problem? For myself, I carefully went through the papers scheduled for each individual session in the advance program and marked papers that looked of most interest as well as others that also might be worth considering as backups. In addition, I also skimmed the abstracts and summaries after receiving them at the meeting to reduce the possibility that the titles alone didn't provide a good idea of the paper content. After this preliminary assessment, I then tried to work out a schedule to ensure that I'd get to hear those papers that looked most worthwhile from my perspective. But, as you've probably experienced yourself, coffee breaks and chance hallway meetings have a way of upsetting this schedule. Besides, I found it to be very difficult to choose from among two, and sometimes more, of the papers that I had selected being presented at the same time, and so often just gave up and looked for interesting conversations in the hallway.

Most of us have probably observed that the most valuable aspects of these meetings are the hallway discussions anyway, so maybe my indecision in selecting which paper to hear wasn't all that much a loss. But the point is that we're faced with more choices about what to devote our time and attention to, as a result of encountering more raw information at meetings, in journal publications and from other sources. That's one, and the more charitable, of the conclusions we might draw.

The other is that there may not really be all that much more information that's new and worth pursuing anyway, but just much more material being published and presented. For example, the AP-S symposium digest was *one* volume through the 1978 meeting, it was *two* volumes from 1979 through 1987, it changed to *three* volumes for 1988 and 1989, and this year it is *four*. (Page counts would reveal a quantitatively different, but qualitatively similar trend. Actually, choosing to publish the AP-S digest in four volumes this year, one for each day, was done primarily for convenience by this year's organizers to eliminate the necessity of carrying more than one volume on a given day.) AP-S and URSI, in particular, haven't as a matter

of policy rejected very many contributions submitted to these yearly meetings. One result of this policy might be that these meetings are becoming more "smoke" than "fire," the smoke being the amount of papers presented and the fire being the actual new information. However you interpret a 13- or (18-) parallel-session meeting, I think that you'll admit the possibility that attendees might experience some sort of information overload.

If you agree with the proposition that we are increasingly subject to information overload, one question needing consideration is its origin. An obvious source is the increasing numbers of people working in science and technology in general. You've probably heard the observation that something like half (or whatever) of the scientists who've ever lived are now alive. When dealing with the specific technology areas of interest to us, however, it may not be so obvious that the number of workers has commensurately increased. In the United States especially, we seem to be experiencing a decline in popularity of "ElectroMagics" (as it's perceived by many students who are involuntarily exposed to it) as a potential field of study compared with some of the "more modern" topics such as computers. On the other hand, the attendance at meetings like the one just held has been growing, so the number of practicing electromagneticists must nevertheless be increasing, or at least the number attending meetings, compared with ten or twenty years ago. And, just as more operations are performed when there are more doctors, more articles are published and papers presented when there are more EMers.

Besides a growing population of EMers being one possible cause of an increased information flow in electromagnetics, another has to be the growing ubiquity of the computer as a research tool. In the mid-1960s, computer modeling was novel enough that the few papers then devoted to numerical techniques at a meeting might merit one special session. In the intervening years, the number of sessions that could be identified as "computer based" has continued to grow. Today, so many papers fall in this category that most are no longer classified as numerical or computational, but are instead defined by the application or by the specific subset of numerical techniques into which they fall, iterative solution methods, for example.

Computers have affected the EM information flow in many ways. Measurement techniques have been revolutionized by computerization, which has made into practical tools approaches which were heretofore only theoretical curiosities. The near-field scanning range and inverse synthetic-aperture radar are two obvious examples. Computers have had a similar impact on analytical techniques, by stimulating study and development of approaches whose utility could not be realized without a capability for doing substantial "number crunching." Examples here include the geometrical theory of diffraction (and its other spinoffs), the theory of frequency-selective surfaces, analysis of stratified and inhomogeneous media, and time-domain phenomenology.

In addition to broadening the horizons of what is analytically and experimentally possible, computers have expanded, almost unimaginably, the number and variety of problems being modeled computationally. It's not that numerical solutions haven't been around for awhile, going back even to the days of Maxwell, but that so much more can now be readily quantified through computation. We had a numerical computations group in the Radiation Laboratory at the University of Michigan when I arrived there in the late 1950s. This computation group was much like the kinds of groups that might be found today, with one major difference. Today one would expect a serious computing activity to have access to a variety of computers ranging from national supercomputer centers, to

local mainframes and mini's, and to workstations and desktop PCs. Back then our computer group used mechanical calculators, and the programmer's job was to develop not only a numerical algorithm but a series of data-flow sheets for intermediate results to be transferred between the various operators. This must have been the first distributed computer!

The operation-count rate for this form of computing was relatively slow compared with even the first PCs, let alone with the 68000 and 386-based PCs of today deliver, not to mention supercomputers. A reasonable estimate for a human operator punching in 8-digit numbers and recording the results upon completion of a series of computations would be two to four operations per minute, or 0.05 FLOPs/sec. Compare this with your own PC, which probably delivers from 10^5 to 10^6 FLOPs/sec.

But the difference in FLOP rates is only part of the story. Consider also that there weren't too many computing groups around like the one at the Radiation Lab, so the total numerical output in electromagnetics circa 1958 must have been minuscule. Assuming that there were 100 groups in the United States producing an integrated output of 50 FLOPs/sec, and further assuming that this output was sustained 24 hours per day for a whole year, the yearly output would be about 2 GFLOPs. This is about the output of a single present-day supercomputer in **1 second!**, a ratio on the order of 2×10^7 . If there were only the equivalent of one supercomputer being used exclusively for EM modeling today, a very conservative estimate, this number would give some idea of how much more output is now being generated than was the case about 1960. Even allowing for some distillation of the raw numbers into final results, we see computing solutions as one other source of the information explosion in EM.

Another impact of today's computer technology is the totally different area of desktop publishing. As it has become easier to prepare the graphics, tables, written text and equations that are part of an article or report, it's probably safe to conclude that more publications result therefrom. Probably also, because it's easier to prepare vignettes and slides, there are more presentations prepared as well. My own experience has been, since first acquiring my Macintosh computer in 1985, that my approach to writing reports and articles, and preparing visuals for presentations, has changed completely. I formerly wrote paper drafts longhand, which were then typed in one, sometimes several, drafts by my secretary, with each requiring thorough and careful proofreading, which was not my forte. Now I compose the original draft at my computer keyboard and catch all misspellings (theoretically at least) using a spell-checker program. Furthermore, most of the graphics and diagrams that are needed can also be handled by my PC, so that I have become essentially independent of both the typing pool and drafting departments. The only step in common with my former, pre-PC life, is the mandatory, and usually advisable in any case, editing required by my organization. The result of all this is that I probably produce much more output in documentation and presentation forms, another source of the information overload.

Not all of the above is bad, by any means, but it certainly does mean that all of us are immersed in a rising tide of raw information, and without some appropriate flotation device, may be in danger of drowning. What sort of flotation, you ask? Well, information-management tools that make it easier to sort through all this stuff for one thing. Unfortunately, while such tools are available for some aspects of our work, they have not yet been developed to handle most of the sources from which such information originates. Most of us probably use various kinds of spread sheets, database programs and other productivity tools to help us keep track of addresses, lists of items important in our work, and maybe even article and book

directories. But, because most of the journals, periodicals, and other information sources still come the "old fashioned way," in hard copy of the kind that started with Gutenberg, we can't bypass the labor-intensive step of manually entering the needed data in our data bases. If you've tried this approach, you soon find that keeping the Database up to date eventually seems to become not the means to an end, but the end itself.

Sooner or later we can expect that these kinds of data-entry activities themselves will become computerized. For example, when IEEE publications are eventually provided on compact disks and so can be computer searched for key words and phrases, then it should no longer be necessary to archive our own individual versions of same. Imagine how much more efficient it will be someday to have journals and other publications available on CD ROMs. The savings in trees alone will be enormous! In addition, instead of devoting many feet of bookshelves in our home and work offices to paper copies of journals and books, they could all be stored in a few CDs. But with increased communication bandwidths, through fiber-optic systems, it shouldn't really be necessary to have our own personal copies of such things at home or in the office anyway. Instead, we can access them at central repositories and download copies of documents that we require, either to our own CD storage systems or in hard-copy form.

At any rate, one way to confront the information explosion is to exploit the technology that's responsible for creating it in resolving the problems it's causing. At least then we may be able to more confidently confront the tide of information with some hope of staying afloat. But this solution is, still in all, only an electro-mechanical one which helps us manipulate data more easily and at higher bandwidths. However, it doesn't solve the more fundamental problem of trying to comprehend and understand the increasing quantities of information to which the technology exposes us, something that may require that we ourselves evolve towards becoming more efficient at processing information. Perhaps also making more use of visual data presentation will increase our "comprehension bandwidth" and exploit one human strength where we still seem to be ahead of computers. Which seems to lead back to the beginning comments in this column about facing the problem of information overload. Hmmmmmm. Maybe now I understand better the saying "Stop the world, I want to get off."

EM Software Validation Workshop: Benchmark Solutions

One of the computation-related (though not necessarily PC) events held at this year's AP-S meeting was a follow-on workshop sponsored by the EM Modeling Software Committee. This year it was called "Software Validation: Benchmark Solutions." Its purpose was to develop a set of problems for which solutions would be solicited, to begin development of a Database, as well as presenting the results in some appropriate publication such as the AP-S Transactions or Magazine or the ACES Journal. Included below is a brief summary of the 1990 Workshop, and because of its general interest, the report developed by the combined DATABASE/POLICIES AND PROCEDURES Working Groups.

Introduction — Edmund K. Miller, Chairman

Our first workshop in San Jose, CA, at the 1989 meeting consisted primarily of presentations intended to elicit the perspectives of code developers, sponsors and users concerning model validation together with a variety of sample validation exercises, a format that allowed relatively little time for actual workshop discussion among the working groups (Wires, Surface and Penetrable Objects, Time Domain, Policies & Procedures, and Database Issues) that were formed. The goal for

this year's workshop was to have the working groups spend most of the day getting down to "brass tacks" in terms of developing specific action plans and deliverables, and individuals/organizations who would agree to provide needed inputs and services. Because participants who attended this year's workshop were not evenly dispersed among the five working groups formed last year, the Policies and Procedures and Database Working Groups were combined. The body of the report which follows essentially reproduces the material provided to me at the end of the Workshop, or shortly thereafter, by the Working Group Leaders.

The workshop began with a few introductory comments by Ed Miller, following which the Leaders summarized the status of each of the four Working Groups and the activities planned for the day. Some specific points discussed are worth noting:

1) Ed Miller announced that he had notified David Chang, President of AP-S, of his desire to be replaced as Chairman of the EM Modeling Software Committee.

2) He also observed that in spite of good intentions to continue the activities initiated at last year's workshop, the most tangible output so far was the report prepared from inputs provided by the Working Group Leaders. This situation should be improved this year by persuading the Workshop participants to commit themselves to providing solutions to specific benchmark problems for possible inclusion/summation in an article for publication in the AP-S Transactions or Magazine and/or ACES Journal or Newsletter. As a means of making this more manageable, Ed proposed that last year's problem lists be examined critically with respect to a proposed benchmark problem's utility and feasibility of solution, particularly with respect to its being done on a voluntary basis. He further proposed that three categories of problems be identified, as: *Category A*) results to be provided by September 30, 1990; *Category B*) results to be provided by December 31, 1990; and *Category C*) results to be provided at a later date.

3) Also a means of making the Committee more viable, Ed suggested that consideration be given to pursuing funding to cover some of its expenses from appropriate government sources. The recent funding received from the National Science Foundation by the CAEME Committee (Computer Applications in EM Education) through the IEEE and AP-S shows that this can be done.

4) In addition, if free computer time might be solicited from various supercomputer centers, or free measurements might be made at various measurement facilities, this could be an additional avenue for accomplishing the committee's goals.

5) An observation similar to (4) applies to the possibility of setting up an electronic bulletin board and Database, possibly using services such as those provided by Argonne National Laboratory through *Netlib*.

Included with the report provided to Workshop participants are copies of a series of articles that appeared in the April 1990 Journal of the Acoustical Society of America (pp. 1497-1545) in which are presented benchmark solutions for a series of problems in underwater acoustic propagation. Leo Felsen, who has been largely responsible for initiating this activity, thought that this set of papers might provide some ideas for our Committee to consider. He comments in a letter, also included with the report, that we should plan on getting a similar set of results published in the AP-S Transactions.

Because the Policies & Procedures and Database areas are of generic interest to anyone who might consider becoming involved in developing solutions for benchmark problems, I include below the report prepared by Bill Stuart, acting Leader of these activities at this year's Workshop.

Policies & Procedures and Database Issues — Bill Stuart, Acting Leader

Since only eight persons were available for both subcommittees and since the Database issues are largely related to Policies & Procedures, the two Subcommittees met jointly at this Workshop. The two Subcommittee reports from the first Workshop were endorsed.

Under new business, three related topics were discussed. The first was "Where should the Database be located?" The second was "How should the Database be funded?" The third was "How elaborate should the Database be?" There was no opposition to the suggestion that the Database be located at the Los Alamos National Laboratory.

To obtain funding, it was recommended that a request be made to the IEEE that the EM Modeling Software Committee be upgraded from Ad Hoc to regular status and some accomplishments be publicized. In order to have some accomplishments while still in an unfunded status, it was recommended that the Database start simply. It was felt that the Database should include information on solutions to problems, measured data, and computer codes. The other Working Groups are assumed to be gathering information on the first two categories. Donald Herrick of ERIM will prepare a questionnaire by the end of July asking for information on codes. The questionnaire will be submitted to the AP-S Magazine and the ACES Newsletter for publication. Costas Tsatsoulis of the University of Kansas will summarize the responses and prepare a listing of those received by 1 January 1991 for general distribution at the Symposium hosting the next Committee meeting. Ideally this will be a diskette to be inserted in a personal computer attached to a printer. Thus, persons may search the list as was done for the exhibits at this Symposium.

The type of information that will be on the questionnaire is as follows:

- code name
- theoretical basis
- numerical technique used
- applications of code
- benchmark performance
- availability
- host computer system including software requirements (e.g., windows, language, operating system)
- special software needed
- author
- support available
- special features
- special requirements/limitations.

It was recommended that it be planned that the Database would have long-term growth. This would include a code library and support for the codes as is done by the Survivability and Vulnerability Information and Analysis Center (SURVIAC). This would be in addition to the files of solutions (calculated, measured, or analytical). Bill Stuart will prepare a draft list of key words for this portion of the Database and circulate it for comments to selected people by September 1. This portion will include information such as follows:

- code used (which version) (date)
- brief description of theory and numerical implementation of code
- echo of input
- any comparisons done with measurements or analytic solution
- results accessible for further comparison
- equations for any analytic solution
- computer and operating system (version) used

CAEME (cont. from page 24)

A variety of computer hardware platforms were available for authors to demonstrate their software. Several software packages were distributed free to the participants to assist them in planning and organization of course materials.

CAEME Workshop Proposed for 1991 MTT-S International Symposium in Boston

This workshop would follow the successful AP-S workshop (see "1990 AP-S Workshop") to support CAEME activity through presentation and demonstration of new computational tools and software packages for electromagnetics education. It would provide MTT-S participants with an opportunity to enhance this effort with complementary ideas and disciplines. An agenda is planned to allow participants to review the CAEME initiative, identify with projects or interest in EM education, discuss the role of industry and government and future needs.

CAEME First Book

According to the terms of the CAEME proposal to NSF, three books will be published, which include developed, tested, and approved software for EM education, during the three years of NSF funding. The center will also acquire copies of these packages and make them available to the publication subcommittee for evaluation. Some CAEME funds will be used to upgrade some selected packages, change the hardware platforms to PC's and Macintoshes, and help bring others to set standards. An RFP for seed CAEME funds for educational software development was published in the May issue of the *IEEE Spectrum*. Copies of the RFP were sent to all Electrical Engineering Departments in the United States universities. We are very glad to report that CAEME received 30 proposals

addressing a wide variety of software development for education. Final decisions for awarding grants will be made in the CAEME Policy Board meeting on June 20, 1990. Upon completing the selection and finishing the upgrading and evaluation processes, authors of selected software packages will be asked to contribute chapters to these CAEME books.

Additionally, in at least one of the CAEME books, focus will be placed on two or three large and general-purpose computer programs that may be made available at a small fee for education. In other words, in addition to including small software packages that are available at different institutions, licenses to distribute a limited number of large and general-purpose programs will be negotiated to make these tools available for education. Your thoughts on this issue and suggestions of large and general purpose packages that may be pursued would be appreciated.

Concluding Remarks

It was almost a year ago that the NSF proposal was submitted. In September 1989, the CAEME center calibrated its successful funding. Shortly after, the honeymoon was over and all of those involved recognized the immense responsibility and the incredible amount of work needed to achieve CAEME objectives. The project is very ambitious and will require dedication, cooperation, commitment and man hours of hard work. On the other hand, it is a unique and exciting opportunity to boost electromagnetics education. It is exciting for our society to join with AP-S and ACES in seizing this opportunity to make a difference. Congratulations to all who envisioned the CAEME venture, volunteered and put so much of themselves into it, and who are committed to its success. The MTT-S offers its assistance and help in securing the future.

Appendix A

(Edited)

Reviewers' Comments From NSF Evaluation of CAEME Proposal

"This proposal addresses a critical problem in electrical engineering education and electromagnetics education. The PI is correct in his concern that students are turned off by the relatively mathematical and abstract nature of electromagnetics. The use of computer-assisted instruction, as proposed, should be a valuable tool in reversing this trend through visualization and intuition. The IEEE AP Society has excellent credibility and its access to the National EE Department Heads Association should insure wide dissemination and adoption of the tools generated by the proposed effort. Some attention should be directed toward debugging the software generated by this effort."

"This is an excellent and timely proposal. I am so pleased to see someone address an area which is so significant to the whole of electrical engineering. Students, especially those in the high speed switching areas (digital related courses, micro-electronics, devices) must become reoriented to this field. I like it."

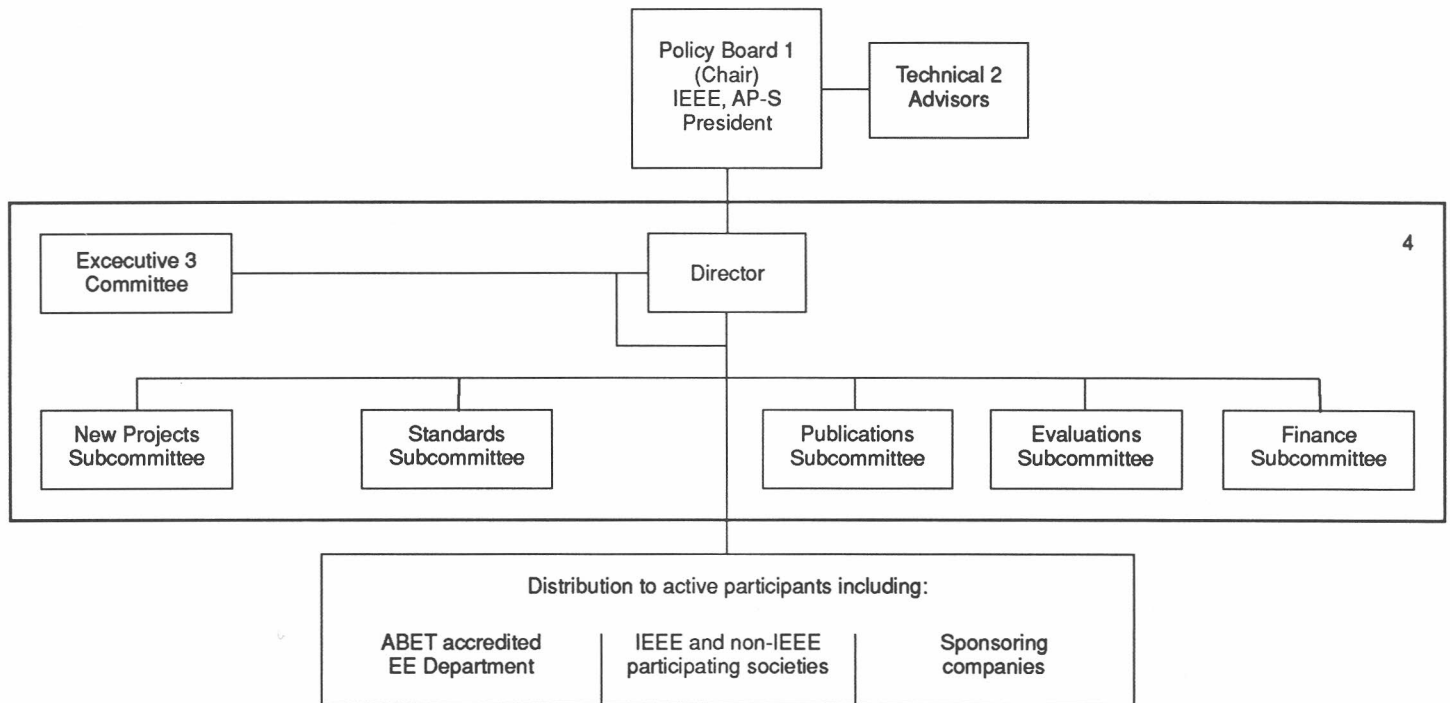
"There is great merit in having an organization such as the IEEE Antennas and Propagation Society undertake a project described in the proposal to benefit all in electromagnetics education. The preparation of a book of software for solving electromagnetic problems, with contributions from various authors, is an excellent goal. The PI has excellent credentials."

"Much needed work, especially since E & M does not attract enough students. Impact can be very broad. Since it will come from IEEE it will be better received. Real goals and specific objectives are somewhat obscured by a rambling discussion."

"Addresses a major need. Can have a major impact. Excellent dissemination plan. Provides access to a very broad network (NEEDHA). All the right players are involved."

Appendix B-1

Organizational Structure for the CAEME Center



1. IEEE, AP-S is the host society. President of AP-S is chair of the Policy Board.
Membership includes:
 - NSF representative
 - IEEE executive office representative
 - CAEME Director
 - Designated representative from ADCOM of participating societies
 - Representative from sponsoring industries

- NEEDHA representative
 - Corporate and Societies Development member
2. Distinguished members of IEEE participating societies.
 3. CAEME Executive Committee consists of the Director and all chairs of subcommittees.
 4. CAEME Center.

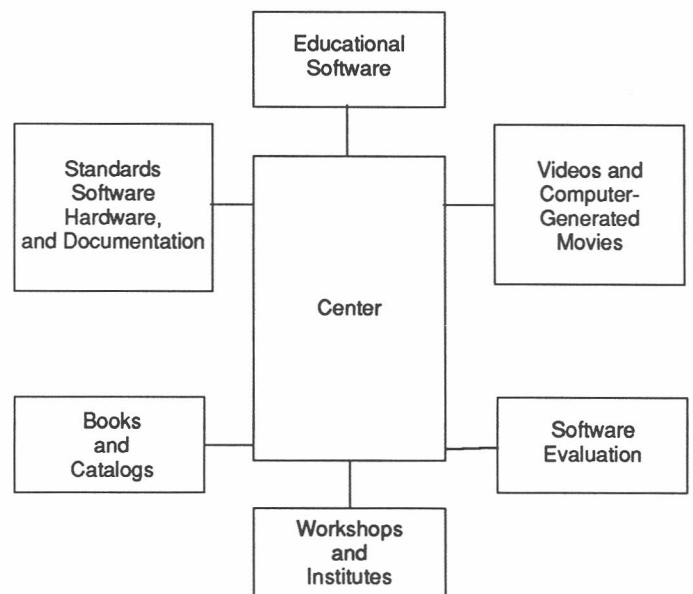
Appendix B-2

CAEME Technical Activities and Products

Purpose of CAEME Center

- CAEME Center was established as a result of a grant from the Division of Undergraduate Science, Engineering, and Mathematics Education of the National Science Foundation.
- Objective: Stimulate and accelerate the use of computers to help boost electromagnetics education.
- Procedure:
 - Publish a catalog of available software and three books of tested and approved educational software packages.
 - Provide seed money to develop innovative computational systems and tools for education.
 - Hold workshops and training institutes (two per year) to report progress and exchange ideas.

- Sustain inter-university cooperation and provide an effective mechanism for distribution under NEEDHA supervision.



Appendix B-3

NSF/IEEE Center for Computer Applications in Electromagnetics Education

CAEME

Policies and Operational Procedures*

1. Purpose

The NSF/IEEE CAEME Center is established to stimulate, accelerate, and organize the use of computers in electromagnetics education. The Center is funded by the Division of Undergraduate Science, Engineering and Mathematics Education of the National Science Foundation, and managed by the Executive Office of the Institute of Electrical and Electronics Engineers (IEEE) on behalf of the Antennas and Propagation Society, the host society during the active period of the NSF grant. The Center's goals are to stimulate the use of computational systems and tools in developing innovative techniques for teaching electromagnetics and to accelerate the integration of computing and advances in computer graphics into the electromagnetics curriculum. The CAEME Center will help sustain inter-university cooperation in the preparation of curricula and the creation of new and innovative educational aids. Under the terms of the NSF grant, the CAEME Center is expected to be active and self supporting after the three years (1989-1992) of NSF funding.

2. Organization

The activities of the CAEME Center are reviewed, evaluated, and approved by a Policy Board. In addition, a group of independent technical advisors initially appointed by the IEEE, AP-S President, and added to as specified herein, will make recommendations to the Policy Board regarding focus and directions of these activities. The detailed operation of the Center is the responsibility of its director and is made according to the guidelines set by the Policy Board. The CAEME Director is also responsible for setting up subcommittees and task forces as needed to facilitate carrying out the various tasks and responsibilities. The director will be assisted by an executive committee which includes the chairs of the various subcommittees and task forces. A chart of CAEME organization is given in Appendix B-1. The distribution of the CAEME products is also a responsibility of the Center's Director. National Electrical Engineering Department Heads Association (NEEDHA) supervises the distribution of CAEME products.

3. Policy Board

3.1 Purpose

The Policy Board is the governing body of CAEME, and has financial responsibility for its operations within the content of the NSF Grant.

The Policy Board insures proper liaison between CAEME and other IEEE and non-IEEE Societies and the industrial sponsors.

3.2 Membership

The Policy Board is chaired by the President of the IEEE Antennas and Propagation Society, host society for this CAEME project for the duration of the NSF grant. Board members include: NSF program director, a representative from the IEEE executive office, the Chair of NEEDHA or his/her designated representative, the CAEME Director, corporate and society liaison member, and a designated representative from each participating society and industrial sponsor.

3.3 Duration of Membership

- During the active period of the NSF grant, the Chair position on the Policy Board is reserved for the position of the IEEE AP-S President. The individual occupying this position at any given time serves for the duration of the presidential term in accordance with the bylaws of the Antennas and Propagation Society. After the active period of the NSF grant, the chair will be elected from among the active board members.
- The Chair of NEEDHA occupies a permanent position on the Policy Board. The individual occupying this position at any given time serves for the duration of the chair's term in accordance with the practices of NEEDHA. The NEEDHA Chair has the option to serve as a member of the Policy Board or to delegate this position to another NEEDHA member.
- The CAEME Director and the corporate and societies liaison member serve three-year terms on the Policy Board. Membership of either on the Board may be extended for one additional year by majority vote of the Policy Board.
- Each industrial sponsor or participating society may name one representative to the Policy Board from its own membership. Such individual representatives serve for a full term of three years subject to the continued society participation or company sponsorship. The term of these members may be extended for one additional year by majority vote of the Policy Board. No individual will serve more than four continuous years on the Policy Board.

3.4 Technical Advisory Committee

An important aspect of the CAEME Center is independent evaluation of its products and development. The Technical Advisors group is nominated by IEEE participating societies and appointed by the Policy Board. Members are appointed for a three-year term. The Advisory Committee evaluates CAEME products, and recommends projects and focus of emphasis to the Policy Board. Such evaluations may be performed at the request of NSF, IEEE, or any of the participating societies of CAEME.

3.5 CAEME Center Director

The CAEME Center Director makes arrangements for meetings, authorizes expenses (according to budget guidelines), prepares and distributes the CAEME catalog, prepares, publishes, and distributes CAEME books, and coordinates two CAEME general workshops per year. The Director will also engage in discussions with interested societies and industrial sponsors who may be candidates for memberships. The Director will serve for a three-year term, plus one additional year by majority vote and will be compensated with 10 percent of his/her yearly salary.

The position of the Center Director is reserved for the PI on the NSF-funded project. After the active period of the NSF

grant, the CAEME faculty elects the director from its current membership. Final appointment is made by the Policy Board.

3.6 Quorum

Two thirds of the members of the Policy Board need to be present to form a quorum.

4. CAEME Faculty

4.1 Purpose

The CAEME faculty is responsible for carrying out tasks, projects, and for the delivery of CAEME products. CAEME faculty may be either a member of one of the ongoing subcommittees and task forces, or an individual working on a CAEME-sponsored project. Since the purpose of CAEME is to sustain inter-university cooperation in developing and sharing software for undergraduate electromagnetics education, the organization of the CAEME Center reflects a focus on achieving this goal.

4.2 Membership

It is a goal of the CAEME Center to have representatives from all ABET-accredited Electrical Engineering Departments with research or instructional efforts in developing computer-generated teaching aids and/or computer-aided design and analysis of electromagnetics problems for use in undergraduate education. Industrial members will also be sought to provide an important practical perspective to CAEME projects. Additional membership may be requested for adequate Society representation.

Persons designated as CAEME faculty are expected to actively participate in CAEME-sponsored projects, subcommittees, or task forces. Seven CAEME members are included in the NSF proposal. Additional members both from academia and industry will be added periodically so that terms of committee members will not expire at the same time. Procedurally, membership in CAEME requires:

- a. Recommendation by a majority vote of active CAEME members;
- b. Assurance that there is no more than one member from a single university, company, or government laboratory/office. The term of membership is three years.
- c. Membership will be renewed at the same time yearly and automatically expires with the completion of a specific CAEME project and a dissolution of a subcommittee.

4.3 Executive Committee

The Executive Committee consists of the Center Director and the chairpersons of the subcommittees and task forces. The Center Director may add to the executive committee one or two members at large to assist him in carrying out the Center's tasks and long-range plans.

All individuals holding seats on the Executive Committee are to be working CAEME members engaged in the development of software or other products for electromagnetics undergraduate education. Membership of the Executive Committee is renewed yearly and automatically expires with the completion of the tasks of any subcommittee.

The responsibility of the Executive Committee is to report to the Center Director its subcommittee findings and progress, and to suggest changes as needed to accomplish their tasks. The budget requests of the subcommittees and any changes in their procedures should be approved by the Director.

4.4 Accounting

Accounting reports will be made to IEEE Headquarters, to the treasurer of participating societies, and to the representative of any other participating entity that requests it.

5. Participation and Sponsorship

5.1 IEEE Electromagnetics-Based Societies

CAEME welcomes participation by all IEEE electromagnetics-based Societies and other IEEE Societies that may be interested in electromagnetics education. A fee determined by the number of members in the Society is required.

- a. For Societies with more than 3,000 members, the yearly membership fee is \$5,000.
- b. For Societies with less than 3,000 members, the yearly fee is \$3,000 per year.

5.2 Non-IEEE Societies

Participation by non-IEEE Societies must be approved by the Policy Board of CAEME subsequent to review and recommendation by the General Manager of the IEEE. Membership fees similar to those of IEEE Societies will apply.

5.3 Industrial Sponsorship

In the first year, a flat fee of \$5,000 per year will be charged to each industrial sponsor. In return, the sponsors get copies of CAEME's products, and may participate in its workshops and institutes. After the publication of the first CAEME book, the membership structure will be as follows:

- a. Full members: Each will be charged a yearly fee of \$10,000.
- b. Associated members: This grade will be reserved for small businesses with annual sales of less than \$5,000,000. A membership fee of \$5,000 per year will be charged. Associated members are entitled to CAEME products and to a nonvoting seat on the Policy Board.

5.4 Electrical Engineering Departments

Due to the NSF sponsorship, CAEME catalog and the first three books will be distributed free of charge to all ABET-accredited EE Departments. In the second year, a voluntary fee of \$500 per year will be solicited to initiate efforts towards achieving a self-supporting CAEME Center. After the active period of NSF funding, CAEME products will not be sent to non-member EE Departments.

6. Subcommittees and Task Forces

To help the director of the Center carry out CAEME projects, the Executive Committee may establish one or more Subcommittees and Task Forces of one or more persons each. Examples include the Finance, Publications, New Projects, Standards, and Evaluations Subcommittees. The director, in collaboration with other members of the Executive Committee, may recruit for and appoint to Subcommittees and Task Forces members who are not necessarily members of the CAEME faculty. The Executive Committee will have the authority at any time to fill vacancies in any such Subcommittee or Task Force, to change their membership or to discharge the Subcommittee or Task Force. The responsibilities of Subcommittees are as follows:

- a. New Projects Subcommittee:
Study and develop ideas for instruction in undergraduate electromagnetics.
- b. Standards Subcommittee:
Help develop mechanisms to encourage software developers to adhere to recommended standards; encourage convertibility between systems developed at different universities.
- c. Publication Subcommittee:
Prepare the CAEME books, conduct software testing, and evaluate the end products. Terms of members expire with the completion of a specific project.

d. Finance Subcommittee:

Plan, coordinate, and direct CAEME fund-raising activities, establishing liaison with IEEE and non-IEEE electromagnetics-based societies, societies interested in education, and with potential industrial sponsors. No departures from the established fee structure (item 3) will be made without approval of the Policy Board. In all cases, final membership approval will be the prerogative of the Policy Board. This subcommittee is also responsible for recommending to the Director steps towards making CAEME a self-supporting Center.

e. Evaluations Subcommittee:

Identify available software packages suitable for evaluation by CAEME and recommendation of test sites for carrying out the evaluations.

7. Meetings, Conferences, and Workshops

The CAEME Center will hold two two-day meetings annually for general coordination, review of subcommittee activities, and report of new developments by members. The meetings will be held in conjunction with symposia of the participating societies.

Additional one-day workshops and/or training institutes will be held as needed. Workshops will be organized to address and coordinate various aspects of CAEME activities. Disbursement of the proceeds from these workshops will be negotiated with the appropriate Ad Coms of societies on a case-by-case basis. The workshop proceeds will be used to support the center activities.

8. Grants and Contracts

The CAEME Center will provide seed funds to encourage research and development of new software for undergraduate education in electromagnetics. In addition to the NSF grant funds, CAEME may choose to use some of the funds raised from Society participation and industrial sponsorship to support its curriculum development activities. Such use must be approved by the Policy Board.

- a. The New Projects Subcommittee has responsibility for identifying critical needs of software in classrooms and avenues to take advantage of the rapidly expanding computer technology.
- b. The CAEME Director presents the New Projects Subcommittee's findings to the Policy Board and requests a budget to carry out the recommended projects.
- c. With the approval of the Policy Board, advertisements of availability of grants (requests for proposals) and areas of interest will be placed in the AP-S newsletter, newsletters of the participating societies, and in the IEEE Institute. Copies of the advertisement will be sent to all ABET-accredited Electrical Engineering Departments through NEEDHA's distribution system.
- d. Shortly after the proposals deadline, the Subcommittee on New Projects will meet, review, and prioritize the received applications.
- e. The recommendations of the subcommittee will be submitted to the CAEME Director via the subcommittee chair.
- f. The CAEME Executive Committee makes recommendations, prepares, and submits the budget to the Policy Board via the CAEME Director.
- g. The Policy Board, at its option or at the request of the National Science Foundation Directorate for Science and Engineering Education, may seek the guidance of the group of independent Technical Advisories in evaluating the recommendations. The Policy Board makes final decisions and announces the grant awards.

- h. Members of the New Projects Subcommittee may be appointed to serve in technical liaison roles on these grants. Otherwise, the CAEME Director will assume this responsibility.

- i. Funds for the amount approved by the Policy Board will be allocated for use by the Principal Investigators of these grants, according to the approved itemized budgets. Project expenditures are monitored by the CAEME liaison and are reported to the CAEME Treasurer.

9. Products and Distribution

The main CAEME products are a software catalog and three books to be published during the three years for which NSF funding has been provided.

9.1 Catalog and Books

CAEME will prepare a catalog of available software, its sources, and a brief description of its function. Copies of the catalog will be distributed on diskettes.

Plans for the preparation and publication of the CAEME books will start immediately after the preparation of the draft of the catalog. A Publication Subcommittee will work with the Executive Committee to determine software to be included in these books. Computer codes with broad utilization, of significant impact on undergraduate education, suitable for teaching fundamentals of electromagnetic theory, will be converted to hardware and software standards set by CAEME and sent for review to selected test sites. Upon evaluation of results from classroom testing, suggestions will be made to authors to assist their final preparation of the manuscript to be published in the book.

9.2 Distribution

- a. NEEDHA will provide a focus for distributing information about CAEME activities and opportunities. This includes notices of conferences and workshops, request for proposals, advertisements for participation at test sites, and availability of CAEME products. In addition to NEEDHA's involvement, this information will also be regularly advertised in the newsletter/magazine of AP-S and those of other participating societies and in the IEEE Institute.
- b. It will be the responsibility of the CAEME Director to distribute CAEME products. The NSF grant provides some support for secretarial assistance and supplies for the CAEME Director. The Director will cooperate with and obtain the approval of the NEEDHA Chair on all distribution matters. The NEEDHA Chair will play a supervisory role and assist the Center Director in the distribution of CAEME products, including providing distribution lists, notes of additional requests, changes of names and addresses, etc.

10. Amendments

These policies and procedures may be amended, added to, or repealed, in whole or in part, in accordance with Robert's Rules of Order.

Appendix C

Call for Contribution to the CAEME Catalog

The NSF/IEEE CAEME Center for Computer Applications in Electromagnetics Education is developing a comprehensive catalog of available EM educational software. This catalog will be distributed on diskettes free of charge to all ABET-accredited Electrical Engineering Departments, and to participants of the AP-S, MTT-S, and ACES Symposia. Listing in the catalog provides a valuable opportunity to advertise your software, and contact colleagues who have software of interest to you. If you have or know of an EM educational software package and want to list it in the CAEME Catalog, please call or send the information to:

Dr. Magdy F. Iskander
Electrical Engineering Department
3280 MEB
University of Utah
Salt Lake City, Utah 84112
(801) 581-6944

For listing in the catalog, the following information is required:

- Title of software
- Name and address of author(s)
- Availability
- Description of capabilities
- Hardware platform
- Fee, if any

For additional information, please contact Dr. Iskander.

IEEE Fellows (cont. from page 25)

Dr. Richard E. Matick

"For contributions to the development of digital storage systems."

Prof. Umberto Mengali

"For contributions to the theory of synchronization in digital communication systems."

Mr. Louis S. Napoli

"For research in GaAs power transistors at microwave frequencies."

Dr. John M. Owens

"For contributions to the understanding and application of magnetostatic waves in the microwave frequency bands."

Dr. David M. Pozar

"For contributions to the electromagnetic analysis, development, and design of microstrip antennas and phased arrays."

Prof. John L. Prince, III

"For contributions to the development of computer-aided design tools for electronic packaging."

Prof. Tullio E. Rozzi

"For contributions to the theory and modeling of propagation in waveguides with discontinuities."

Mr. Anthony J. Rustako, Jr.

"For contributions to the implementation of diversity combining techniques in cellular mobile radio systems."

Dr. Roberto Sorrentino

"For contributions to the modeling of planar and quasi-planar structures for microwave and millimeter-wave circuits."

Dr. Allen Taflov

"For contributions to the development of the finite-difference time-domain numerical solution of Maxwell's equations."

Dr. Takeo Takemoto

"For technical leadership in development and production of color cathode ray tubes and other display devices."

Prof. Leung Tsang

"For contributions to wave propagation in discrete random media and the theory of microwave remote sensing."

Dr. Rodney S. Tucker

"For contributions to microwave frequency optoelectronic circuits, and the direct modulation of high-speed semiconductor lasers."

Dr. Carmine Vittoria

"For contributions to the understanding of the microwave properties of magnetic materials and their applications in microwave technology."

Prof. Tsukasa Yoneyama

"For contributions to the development of nonradiative dielectric waveguide technology."

PIERS 1991

Progress in Electromagnetics Research Symposium

July 1-5, 1991
Cambridge, Massachusetts

CALL FOR PAPERS

The Progress in Electromagnetic Research Symposium (PIERS 1991) will be held on July 1-5, 1991, in Cambridge, Massachusetts.

PIERS 1991 will provide an international forum for reporting progresses and recent advances in the modern development of electromagnetic theory and its new applications. Listed below are suggested topics. Consideration will be given to papers on other subjects.

SUGGESTED TOPICS

- | | |
|---|---|
| • Time-domain electromagnetics, pulse coupling and distortion | • Medical applications and biological effects |
| • Microelectronic integrated circuits | • Computational techniques |
| • Remote sensing of the earth, ocean, and atmosphere | • Scattering and diffraction |
| • Polarimetric radar scattering | • Tropospheric propagation |
| • Imaging | • Ionospheric propagation |
| • Inverse scattering | • Millimeter, submillimeter, and light waves |
| • Geophysical subsurface probing | • Photonics |
| • Electromagnetic waves in composite media | • Modeling of interconnects |
| • Superconducting electronics | • Microstrip and printed antennas |
| • Random and nonlinear media | • Antenna theory and measurements |
| | • Others |

DEADLINE: ALL ABSTRACTS MUST BE RECEIVED BEFORE DECEMBER 1, 1990

INSTRUCTIONS FOR ALL AUTHORS

Prospective authors are invited to submit a one-page abstract of no less than 250 words. The abstract should explain clearly the content and relevancy of the proposed contribution with complete names and affiliations of the authors. The original and 2 copies of the abstract must be submitted.

ACCEPTANCE NOTIFICATION: JANUARY 31, 1991

INFORMATION AND REGISTRATION

Further registration material and accommodation information will be mailed with the Symposium Program.

Contribution and inquiries should be addressed to:

Professor J. A. Kong
M.I.T., Room 26-305
Cambridge, Mass 02139
Tel: (617) 253-5625
Fax: (617) 253-0987

EMAIL: kong%ewt@mitvma.bitnet
kong%ewt@athena.mit.edu

Two One-Day Radar Courses Back to Back

Day After IEEE Radar-91 Conf.

Lecturer: Dr. Eli Brookner, Consulting Scientist, Raytheon Company, Wayland, MA 01778

Place: Viscount Hotel, Los Angeles, CA (near Radar-91 and LA Airport)

Sponsor: Boston IEEE/AESS

1st Course: Radar Technology

Date/Time: March 14, 1991 (Thursday)/8:00 a.m. to 9:30 p.m.

The course is intended for the beginner and experienced radar engineer. Basic fundamentals are introduced in simple terms. Complicated subjects are explained in simple terms. (These include G-H, G-H-K and Kalman Filters; fast convolver digital pulse compressor; FFT algorithm; detection theory; phased arrays [full, limited and hemispherical (dome) scanning and array thinning]; matched filter; coded waveforms [chirp, phase, nonlinear FM, stepped frequency]; displaced phase center antenna [DPCA]; synthetic aperture radar [SAR]; moving target detector [MTD]; CFAR; SAW devices; and the ambiguity function.) The course is framed around parts of the book *Radar Technology*, edited by Dr. Eli Brookner. This book (which sells for \$72) will be given out free to attendees. Also given out free are paper reprints and supplementary notes (copies of over 800 vugraphs updated to 1991 state-of-the-art technology).

2nd Course: Aspects of Modern Radar

A New Course

Date/Time: March 15, 1991 (Friday)/8:00 a.m. to 5:30 p.m.

This new course is framed around the *Completely New Book: Aspects of Modern Radar* (1988) which sells for \$79 and is being given out free to attendees. Notes will also be supplied updating technology to the 1991 state of the art. This course also is

intended for both the beginner and experienced radar engineer. For both, complicated subjects (e.g., cross section prediction and reduction; and tracking in multipath) are explained in simple terms with the latest developments and future trends discussed. Attendees will be brought up to date on the many other new developments in radar (e.g., the achievement of 50 dB nulling; a Givens systolic array sidelobe canceler being developed providing 64 degrees of freedom; the adaptive-adaptive processor providing orders of magnitude reduction in computations and transient response; residue-arithmetic signal processors; OTH radar; VLSI and VHSIC; ultra-low sidelobe antennas; MMIC; digital beam forming; GaAs chips; SAR and inverse SAR [ISAR]; and solid-state transmitters). The specialist should attend to learn about the areas outside of his specialty, the manager to obtain an overview of the rapid changes occurring in radar and to learn about the complex disciplines that are difficult to learn about from the literature in order to assess the impacts of these new developments on radars of the future. The easy-to-read tutorial course book gives a catalog of over 200 ground, airborne and secondary radars from around the world, together with pictures of many of them. Some of the recent ones will be covered in the course.

For further information, contact:

Dr. Eli Brookner

Raytheon Co.

Wayland, MA 01778

(508) 440-5636 or (617) 862-7014

Meetings and Short Courses of Interest

Meeting	Date	Location	Contact for More Information
International Conference on Millimeter-wave & Microwave (ICOMM-90)	December 19-21, 1990	Dehra Dun, India	In U.S.A.: Prof. Banmali Rawat (702) 784-6927 In India: Dr. A. S. Bains 0135-24779
9th International Zurich Symposium & Technical Exhibition on Electromagnetic Compatibility	March 12-14, 1991	Zurich, Switzerland	Dr. Balint T. Szentkuti + 41 31 62 52 58
1991 U.S. Conference on GaAs Manufacturing Technology	April 7-10, 1991	Reno, NV	Suzanne Kuntz (202) 347-5900
1991 MTT-S International Microwave Symposium	June 11-14, 1991	Boston, MA	Peter Staecker (617) 272-3000, ext. 1602
1991 SBMO International Microwave Symposium	July 22-25, 1991	Rio de Janeiro, Brazil	Mauro S. Assis + 55 21 2167108

FIRST CALL FOR PAPERS

SBMO 91 — INTERNATIONAL MICROWAVE CONFERENCE / BRAZIL

“MICROWAVES: TRENDS TO THE FUTURE”

**22-25 July 1991
Rio de Janeiro, Brazil**

You are cordially invited to submit an original paper.

All areas of microwaves will be considered and special emphasis will be placed on the following aspects:

- Antennas and Phased Arrays
- Microwave Radio Propagation and Radiometeorology
- Terrestrial and Satellite Communications (including DBS)
- Microwave Techniques in Radar, ECM, Remote Sensing and Radio Astronomy
- Scientific, Biological, Medical and Industrial Applications of Microwaves
- Lightwave and Opto-Electronics Technology
- Microwave Superconductivity
- Gigabit Logic
- Microwave Active/Passive Devices and Circuits
- Microwave and Millimeter Wave Components and Systems
- Microwave Acoustics
- Microwave and Millimeter Wave Integrated Circuits
- Field and Network Theory
- Measurement Theory and Techniques
- CAD/CAM
- Modern Microwave Education

For further information, please contact:

Mr. Mauro S. Assis

Chairman of the SBMO-91

EMBRATEL — DDH

Rua da Assembleia, no. 10, sala 2201

20011 — Rio de Janeiro, RJ, Brazil

Phone: + 55 21 2167108

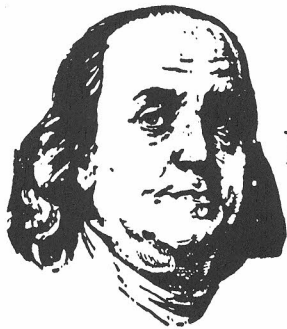
**Telex: + 55 21 9922007
9922008**

Fax: + 55 21 2330195



ANNOUNCEMENT AND CALL FOR PAPERS

IEEE AP/MTT-S
Philadelphia Section



NINTH ANNUAL BENJAMIN FRANKLIN SYMPOSIUM

on
Antenna and Microwave Technology in the 1990s

March 9, 1991

The Philadelphia Chapter of the IEEE AP/MTT-S will hold its 9th Annual Benjamin Franklin Symposium on Saturday, March 9, 1991 from 8:30 AM to 5:00 PM. This one-day symposium will consist of:

Morning Session: Plenary Session of Invited Papers

Afternoon Session: Parallel Sessions of Contributed Papers, on:

- a. Antennas and Propagation: Phased Array Technology, Antenna Design, Radiating Elements and Phase Shifters, Antenna Applications, Imaging and Radiometry, Remote Sensing, Scattering and Diffraction, and Wave Interaction with Complex and Chiral Materials.
- b. Microwave Theory & Techniques: Microwave Networks and Filters, Solid State Devices and Circuits, Millimeter Waves and Monolithic Technology, Ultrafast Optoelectronics, Optical Technologies applied to Microwave, and Microwave Applications.

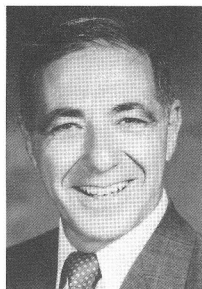
PLACE: Sheraton University City
36th & Chestnut Sts.
Philadelphia, PA 19104

PAPERS: Authors are invited to submit papers in either field. Please send a camera-ready summary (one to four 8.5" X 11" pages with one-inch margins) by January 7, 1991 to:

Professor Nader Engheta
Moore School of Electrical Engineering/6314
University of Pennsylvania
Philadelphia, PA 19104-6390
e-mail: engheta@pender.ee.upenn.edu

FURTHER INFORMATION: Please call Nader Engheta, U. of PA (215) 898-9777 or Afshin Daryoush, Drexel U. (215) 895-2362 or Andrew Ochadlick, NADC (215) 441-1993.

Student and University Participation at the 1991 IEEE MTT-S Symposium



by Prof. Peter Rizzi
Southwestern Massachusetts University
Electrical Engineering Department
North Dartmouth, MA 02747
(508) 999-8479
Fax: (508) 999-8485

For the first time, the IEEE MTT-S Microwave Symposium will include certain activities that are specifically designed to highlight microwave research and development in universities. The activities will consist of a student paper contest and the use of exhibit booths by universities engaged in microwave education and research.

The student paper contest is based upon a proposal presented to AdCom by Prof. Ronald Carter of the University of Texas at Arlington. The contest will be held as part of the Technical Program of the 1991 Symposium. It will be open to both graduate and undergraduate students. The papers will be presented at a special session on Tuesday, June 11th, and will

be judged for content, presentation, and visual materials. First, second, and third prizes will be awarded. Both cash prizes and certificates will be presented to the winners. A panel of judges chosen by the 1991 MTT-S Symposium Steering Committee will select the three finalists. In addition to the awards, travel stipends will be available for students whose papers are accepted for presentation at the symposium.

The Steering Committee is also planning to make available several booths in the exhibit hall for the display of information on microwave research in universities. The concept is similar to that used at the European Microwave Conference. The idea is to make both industry people and students aware of the microwave activities and facilities in colleges and universities. The hope, of course, is that this will encourage more interaction between the microwave industry and academia, as well as generate an increased interest in microwaves among engineering students.

Because of limited booth space, only about a dozen schools will be selected to participate this year. About half the space will be assigned to schools within a few hundred miles of the convention site. The plan is that since the symposium site differs from year to year, the schools selected will vary accordingly. Thus over the years, many institutions will have the opportunity to "show their wares." Since this is a first attempt at this sort of thing, there may be some problems along the way. Please bear with us as we try to make these new activities successful.

Any questions regarding the organization of either the student paper contest or the university exhibits may be directed to the author.



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