

Innovating a Microwave Engineering Conference Program

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The International Microwave Symposium (IMS) is the premier annual event of the IEEE Microwave Theory & Techniques Society (MTT-S). This symposium has been held annually for over half a century, and is the world's largest and most prestigious conference on the technology of RF, microwave, millimeter- and submillimeter wave components, devices, circuits, modules, and systems. Although MTT-S, with approximately 12,000 members worldwide, is only the fifth largest of the IEEE Societies, IMS is one of the largest IEEE conferences and attracts approximately 4,000 attendees annually who come to partake in one or more of the three principal components of the IMS: 1) a program of approximately 500 technical and research papers, 2) educational workshops and short courses at the state of the art, with an enrollment of over 2,000, and 3) an industry exhibit that attracts close to 800 exhibitors who display their latest products and services at the symposium for a period of three days.

The location of the IMS rotates around the United States, and in 2010 it returns to Anaheim, California, having last been held there in 1999. The IMS is scheduled in the Anaheim Convention

Center from Tuesday, 25 May through Thursday, 27 May 2010 and is the centerpiece of the so-called Microwave Week, which comprises still other technical



IMS 2009 attendees enjoy one of the receptions.

activities, including the RFIC Symposium and the ARFTG Microwave Measurement Conference, collocated with IMS 2010 in Anaheim during the week of Sunday, 23 May through Friday, 29 May 2010. A host of other technical activities accompany the IMS, including plenary and panel sessions that bring the world's technical leaders to present their views in Anaheim; historical exhibits containing hardware, books, and photographs from bygone eras; student design competitions organized by the various technical committees (TCs) of the IEEE MTT-S; applications-oriented seminars where industrial vendors present the latest technologies; and specialized meetings dealing with

technical and professional issues also organized by the TCs.

A number of the components of the technical program are described elsewhere in this issue; this article relates primarily to the technical paper presentations, describing original research, development, and application work on radio frequency and microwave theory and techniques in the various areas within this broad discipline. These include papers orally delivered from a podium and accompanied with electronic projection; Interactive Forum Papers, presented in a poster format with an opportunity for display of hardware, demonstration of performance, and extended discussions with interested individuals among the attendees (see page 38 of this

issue); and papers presented at a student paper contest (discussed on page 67 of this issue).

The Technical Paper Program has been compiled with the assistance of an international Technical Paper Review Committee (TPRC), whose roster of approximately 250 members reads like the Who's Who of the microwave field. These experts have painstakingly reviewed the large number of submitted papers and selected only the most innovative contributions that met the stringently applied requirements of being original, quantitatively well supported, clear in their writing, and relevant to the theme of the symposium. Unlike many other symposia in the

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electromagnetics field, the IMS paper selection committee has historically rejected typically half of all submitted papers in order to present the very best work in the field. This year, the acceptance rate was 47% for all papers (including the invited papers) and only 43% for the submitted papers. It is apparent that IMS 2010 is again going

to be of the quality that we have come to expect from the IMS.

It might seem that a conference that has been long established and is spectacularly successful would be in a steady state with few innovations; that is not the case. Many innovations have been introduced this year, and a few of them are briefly described in the following.

Organization of the Technical Sessions

In organizing the daily technical program of the symposium, one of the principal considerations is to minimize the potential conflicts of parallel sessions within the same technical area or with similar technical content, so as to save the attendees from the dilemma of having to choose between them. This organization has been greatly aided by subdividing the technical field of the symposium into four clusters or tracks, each spanning the field of interest that most IMS attendees are likely to have—eclectic microwave engineers with ecumenical interests excepted. The four clusters are

- Microwave Field and Circuit Techniques
- Passive RF and Microwave Components
- Active RF and Microwave Components
- RF and Microwave Systems and Applications.

These clustered technical areas are also the basis for subdividing the process of reviewing the technical papers submitted to IMS, and there are numerous subcommittees of the TPRC within each of these clusters; the TPRC Subcommittees for IMS 2010 are listed in Figure 1.

Interestingly, such a clustering of technical fields of the symposium was introduced (by this author) in 1999, when the IMS was last held in Anaheim. Figure 2 compares the areas of TPRC subcommittees used in the decade prior to 1999 to those used since 1999. Such a comparison of the topical areas within IMS is also of historical interest, since it evidences the evolution of the frontiers of the field covered by IMS. As is apparent from Figure 2, the TPRC was entirely reconstituted in 1999 by replacing the seemingly random list of technical areas organized by the clusters. This major revision of TPRC occurring in IMS 1999 in Anaheim is now followed by another major innovation introduced in the TPRC of IMS 2010 in Anaheim, as described in the following.

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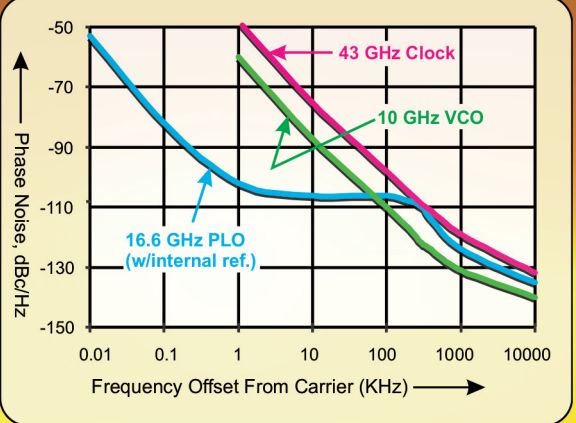
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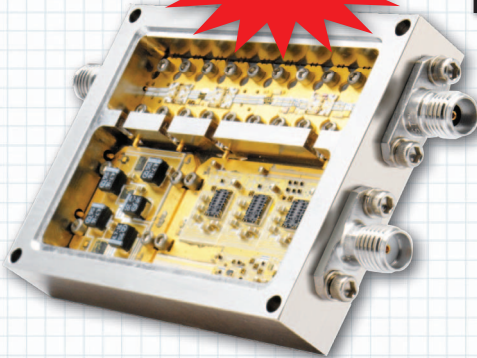
Technical paper evaluations by 35 committees of the IMS 2010 Technical Paper Review Committee in progress in New Orleans, January 2010. Seated, from left: John Kuno, member; Debabani Choudhury, cochair; and Edward Niehenke, chair of the Millimeter Waves and THz Components and Technologies Subcommittee. Standing: Madhu S. Gupta, Technical Program Committee chair.

Introduction of New Technical Areas

One of the innovations introduced this year for the first time is the postsubmission formation of review committees for submitted papers in newly emerging technologies within the domain of the symposium. Traditionally, the scope of the technical program of the symposium is defined by and announced in the Call for Papers in the form of a list of technical areas, with subcommittees of the TPRC constituted in each of the announced areas to review the papers submitted in that area. All submitted papers are then directed to the 30 or so paper review subcommittees in pre-established topic areas. These technical areas have remained relatively stable, although their emphasis may have evolved gradually over time in response to the changes in the frontiers of the field. Relying on such a process

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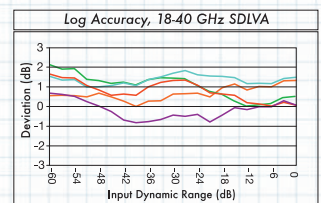
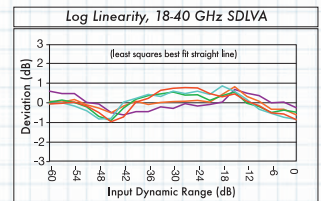
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TPRC Subcommittees for IMS 2010

Microwave Field and Circuit Techniques	Active RF and Microwave Components
<ol style="list-style-type: none"> 1) Field Analysis and Guided Waves 2) Frequency-Domain EM Analysis Techniques 3) Time-Domain EM Analysis Techniques 4) CAD Algorithms and Techniques 5) Linear and Nonlinear Device Modeling 6) Nonlinear Circuit and System Simulation 	<ol style="list-style-type: none"> 14) Semiconductor Devices and Monolithic ICs 15) Signal Generation 16) Frequency Conversion and Control 17) HF/VHF/UHF Technologies and Applications 18) High-Power Amplifier Devices 19) High-Power Amplifier Circuits 20) High-Power Amplifiers 21) Low-Noise Components and Receivers 22) mm-Wave and THz Components and Technologies
Passive RF and Microwave Components	RF and Microwave Systems and Applications
<ol style="list-style-type: none"> 7) Transmission Line Elements 8) Passive Circuit Elements 9) Planar Passive Filters and Multiplexers 10) Nonplanar Passive Filters and Multiplexers 11) Active, Tunable, and Integrated Filters 12) Ferroelectric, Ferrite, and Acoustic Wave Components 13) MEMS Components and Technologies 	<ol style="list-style-type: none"> 23) Microwave Photonics 24) Signal Processing Circuits and GHz Speeds 25) Packaging, Interconnects, MCMs, and Integration 26) Instrumentation and Measurement Techniques 27) Biological Effects and Medical Applications 28) RF Arrays as Antennas and Power Combiners 29) Radar and Broadband Communication Systems 30) Wireless and Cellular Communication Systems 31) Sensors and Sensor Systems 32) High Microwave Power Industrial Applications 33) RFID and Power Scavenging Technologies

Figure 1. The subcommittees of the Technical Paper Review Committee (TPRC) in individual technical areas, organized in four clusters.

of gradual change has the disadvantage of the tendency to discourage large, disruptive changes, such as the introduction of completely new fields that

have previously not been represented in the IMS, and which may appear to be unrelated to the historical scope of the IMS. To rectify this potential bias against the novel areas and ensure that the scope of the IMS does not remain frozen, the Call for Papers for IMS 2010 deliberately set out to invite papers in a new category called “Emerging Technologies,” by announcing the opportunity as shown in Figure 3.

This invitation resulted in the submission of 40 papers under the emerging technologies category, representing a variety of new areas, such as RF nanotechnology, that are included in the technical program of the symposium this year. But, more importantly, among the emerging technology papers, there were two large groups of papers having critical mass, each exceeding 15 submissions in the following two areas:



Lively discussions among the Technical Paper Review Committee members Madhu S. Gupta, Vijay Nair, and John Kuno in New Orleans, January, 2010.

COURTESY TIMOTHY LEE, MTT-S ADCOM MEMBER. PHOTO TAKEN IN JANUARY 2010 IN NEW ORLEANS, DURING THE COMMITTEE MEETINGS.

Pre-1999 IMS TPRC Subcommittees	TPRC Subcommittees 1999–Onward
A) Symposium Technical Group	Microwave Field and Circuit Techniques
AA) Steering Committee	1) Field Analysis and Guided Waves
B) Biological Effects and Medical Applications	2) Frequency-Domain EM Analysis Techniques
C) Passive Components	3) Time-Domain EM Analysis Techniques
D) Filters and Multiplexers	4) CAD Algorithms and Techniques
E) Ferrite Components	5) Linear Device Modeling
F) Acoustics and SAW Components	6) Nonlinear Device Modeling
G) Signal Generation, Frequency Conversion, and Control	7) Nonlinear Circuit and System Simulation
H) Nonlinear Modeling and Analysis	Passive RF and Microwave Components
I) Transistor Power Amplifiers	8) Transmission Line Elements
J) High-Power Sources and Control Components	9) Passive Circuit Elements
K) Low-Noise Receivers and Detectors	10) Planar Passive Filters and Multiplexers
L) Hybrid Technology	11) Nonplanar Passive Filters and Multiplexers
M) Monolithic Technology	12) Active, Tunable, and Integrated Filters
N) Millimeter and Sub-Millimeter Wave Technology	13) Ferroelectric, Ferrite, and Acoustic Wave Components
O) Em Analytical and Numerical Techniques	14) MEMS Components and Technologies
P) Field Theory	Active RF and Microwave Components
Q) CAD Procedures, Techniques and Modeling	15) Semiconductor Devices and Monolithic ICs
R) Guided Waves and Propagation Techniques	16) Signal Generation
S) Measurement Theory and Techniques	17) Frequency Conversion and Control
T) Microwave Communication Systems	18) HF/VHF/UHF Technologies and Applications
TA) Vehicular Technology	19) Power Amplifier Devices and Circuits
TB) Wireless Technology	20) High-Power Amplifiers
U) Phased Arrays	21) Low-Noise Components and Receivers
V) Lightwave Technology and Techniques	22) mm-Wave and THz Components and Technologies
W) Superconductivity Technology	RF and Microwave Systems and Applications
X) Manufacturing, Production and Packaging	23) Microwave Photonics
Y) Digital Microwave Circuits	24) Signal Processing Circuits and GHz Speeds
Z) Active and Quasi-Active Arrays	25) Packaging, Interconnects, MCMs and Integration
	26) Instrumentation and Measurement Techniques
	27) Biological Effects and Medical Applications
	28) RF Arrays as Antennas and Power Combiners
	29) Radar and Broadband Communication Systems
	30) Wireless and Cellular Communication Systems
	31) Sensors and Sensor Systems

Figure 2. Changes in the Technical Areas of IMS, used in the call for papers as well as in constituting Technical Paper Review Committees, which occurred in 1999 when the Symposium was last held in Anaheim, California, with minor variations over the years.

- high-power microwaves for industrial and material processing
- RFID and power scavenging technologies.

Both of these technologies are growing in importance and involve work at the frontier of the field with new and different constraints—very high power levels and thermal issues in the first case, and very low power levels and low cost in the second case. The sub-

missions thus prompted the creation of two new subcommittees of the TPRC in these areas, and the newly constituted committees assisted in the review of the papers in the two areas. This strategy has resulted in an enlargement of the scope of the symposium this year. It also welcomes new technical communities into the folds of the IEEE MTT-S, enlarges the domain of the interest of the Society, and helps the Society stay

abreast with newer developments and fields of intense industrial and professional activity.

Capturing the Benefits of Technical Discussions

One of the primary purposes of the symposium is to provide a venue for discussions and technical exchange between the presenters of new research results and the attendees of

Innovations in TPRC

INVITATION TO PAPERS IN EMERGING TECHNICAL AREAS: The Technical Program Committee of IMS 2010 would like to emphasize in the strongest possible terms that the scope of the 2010 International Microwave Symposium is not limited to the 31 topical areas listed below in this Call for Papers. The Committee is taking deliberate steps to broaden the horizon of the Symposium by including technical areas that, although within the field of interest of IEEE MTT-Society, have not historically had, or do not currently have, adequate representation in the program of the symposium. We enthusiastically invite submission of papers that report results of progress in the state-of-the-art of technological areas that are outside the scope of the listed topics, or are new to the symposium. Illustrative examples of these areas include:

- RF components for very low-cost, high-volume manufacturing in applications like RFID
- Terahertz technology and chips for bioassays
- High-power components and techniques for heating and industrial processing
- DSP techniques for enhancing specifications of RF circuits and RF techniques for enhancing specifications of DSP hardware.

Because these areas will include newly emerging technologies or breakthroughs, an a priori list of these areas can be anticipated.

All papers submitted to IMS must be reviewed by one of the subcommittees of the IMS Technical Paper Review Committee (TPRC) assembled for each respective area (including those for the 31 areas listed below). To accommodate the review of submitted papers in new areas, additional subcommittees of the TPRC will be created essentially in real time, as the need for them becomes apparent from the received paper submissions. The need for new TPRC Subcommittees may arise either when the submitted papers lie outside the domain of any existing TPRC subcommittee, or there is a sizable cluster of papers in a subset of the domain of a subcommittee that justifies its own TPRC subcommittee, or to nurture a budding area within the symposium.

Authors who believe their papers fall in any of those categories are asked to select emerging technologies as the topic during the paper submission.

Microwave Field and Circuit Techniques	Passive RF and Microwave Components
<ol style="list-style-type: none"> 1) Field Analysis and Guided Waves 2) Frequency-Domain EM Analysis Techniques 3) Time-Domain EM Analysis Techniques 4) CAD Algorithms and Techniques 5) Linear Device Modeling 6) Nonlinear Device Modeling 7) Nonlinear Circuit and System Simulation 	<ol style="list-style-type: none"> 8) Transmission Line Elements 9) Passive Circuit Elements 10) Planar Passive Filters and Multiplexers 11) Nonplanar Passive Filters and Multiplexers 12) Active, Tunable, and Integrated Filters 13) Ferroelectric, Ferrite, and Acoustic Wave Components 14) MEMS Components and Technologies
Active RF and Microwave Components	RF and Microwave Systems and Applications
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Figure 3. Invitation for paper submissions to the “Emerging Technologies” category in IMS 2010 Call for Papers.



Madhu S. Gupta, chair of the IMS 2010 Technical Program Committee, making a passionate appeal in New Orleans, January 2010.

the symposium, which occurs during the question-and-answer period following each presentation. Such an exchange not only helps the attendees better understand and appreciate the contribution of the presenters, it also allows the presenters to refine their work and incorporate in it the alternative perspectives brought up through the discussion.

This year, the discussion and exchange assumes an added importance. As in the past, the authors of all accepted papers, whether presented orally or in an interactive forum,

have been invited to submit extended and more completely documented versions of their symposium papers to be considered for publication in a special issue of *IEEE Transactions on Microwave Theory and Techniques*. However, the deadline for that submission is five weeks after the symposium ends, unlike prior years when the manuscripts had to be submitted a couple of months before the symposium presentation had been made. This year, the authors will have an opportunity to carefully consider the questions and alternative interpretations brought up by attendees at the symposium, and use this valuable feedback to improve their papers submitted to *IEEE Transactions on Microwave Theory and Techniques*.

Author Feedback


While the TPRC Subcommittees often provide constructive suggestions to the authors of accepted papers for improving the presentation of their papers at the symposium, there has previously not been any substantive feedback provided to the authors of submissions that were not accepted for presentation at the IMS. In view of the fact that the papers have already been reviewed by the TPRC subcommittees, the incremental effort required to provide such feedback is not inordinately large. In

the interest of encouraging the submitting authors (many of whom are newcomers to the IMS), greater transparency and to dispel the false perception of IMS as an “insider’s club,” this year the TPRC subcommittees were encouraged to assemble the feedback for author use, which was then forwarded to all authors.

Management of TPRC Subcommittees and Their Workload

The TPRC subcommittee members were required this year to submit up-to-date information concerning their own professional interests and publications and their past involvement in IMS reviewing activities through a Web-based questionnaire to develop an electronic database of the expertise within the TPRC. This database serves a number of purposes, including matching the expertise of the members to the area in which they are asked to review papers as well as identifying potential reviewers for papers in emerging technologies.

In order to receive paper reviews of the highest quality, it is important to limit the number of papers that the reviewers are asked to review within a short period of three or four weeks between the submission and the final decision on the papers. We adopted a proactive process this year to ensure that no reviewers were burdened with more than 50 papers (and in nearly all cases, no more than 40 papers) to review. This required subdividing a technical area on a rational basis after the submissions of papers and before the reviewing began. Of course, this also allowed us the opportunity to combine those TPRC subcommittees that received too few papers, since committees with less than approximately a dozen papers do not make efficient use of the volunteers’ time.

We welcome you to the IMS in Anaheim during May 2010. We hope you will give us the benefit of your opinion about the success of our efforts at developing a conference with an outstanding technical program. 



Ke Wu, Madhu S. Gupta, and George Ponchak, members of the MTT Society Administrative Committee and the IMS Technical Program Committee, reviewing the subject of committee discussion; New Orleans, January 2010.