

IEEE CAT. NO. 99CH36282

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# 1999 IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM DIGEST

Volume 1

June 13 - 19, 1999  
Anaheim Convention Center  
Anaheim, California

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**1999 IEEE MTT-S International Microwave Symposium**



JUNE 13-19, 1999 • ANAHEIM CALIFORNIA

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*The Institute of Electrical and Electronic Engineers, Inc.  
Publication Order Department  
445 Hoes Lane  
Piscataway,  
NJ 08855-1331*

<i>IEEE Catalog Number</i>	<i>99CH36282</i>	<i>ISBN 0-7803-5135-5 (softbound)</i>
<i>Library of Congress Number</i>	<i>77-645125</i>	<i>ISBN 0-7803-5136-3 (casebound)</i>
<i>ISSN:</i>	<i>0149-645X</i>	<i>ISBN 0-7803-5137-1 (microfiche)</i>
		<i>ISBN 0-7803-5138-X (CD-ROM)</i>

### ***IEEE MTT-S International Microwave Symposium***

*IEEE MTT-S International Microwave Symposium Digest 1977  
New York, Institute of Electrical and Electronics Engineers  
v. III. 28 cm. annual*

<i>Continues:</i>	<i>IEEE MTT-S International Microwave Symposium Digest of Technical Papers</i>	<i>ISSN 0149-6298</i>
<i>Key title:</i>	<i>IEEE MTT-S International Microwave Symposium Digest</i>	<i>ISSN 0149-645X</i>

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|---|--|
| <i>1. Microwaves-Congresses</i>                             | <i>2. Microwave Devices-Congresses</i>                         |
| <i>I. Institute of Electrical and Electronics Engineers</i> | <i>II. IEEE MTT-S International Microwave Symposium Digest</i> |

<i>TK7876.I184</i>	<i>621.381'3</i>	<i>77-645125</i>
<i>Library of Congress</i>	<i>78</i>	<i>MARC-S</i>

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# **WELCOME to the 1999 International Microwave Symposium**

## **“The Magic Touch of Microwaves”**



Robert L. Eisenhart  
General Chairman

As spokesperson for the 1999 International Microwave Symposium (IMS) Steering Committee, I thank you for coming to Anaheim. I'm sure that you will enjoy your stay. The Symposium theme, "The Magic Touch of Microwaves," is so appropriate because magic is when things happen that aren't seen or understood, except by the one who makes it happen. What better description could be applied to microwaves? We are the Magicians! This is our opportunity to get together and open up our personal "bag of tricks" to each other, and see what all of the presenters have to share.

There is more of "Microwave Week" to see than ever before. The backbone of the Symposium is the presentation of the technical sessions. These have been expanded to spread over four days, Monday through Thursday, reducing the number of short papers and the sessions competition with the interactive forum. The interactive forum has also been expanded from two to three days by reducing the number of papers per session, easing the "crunch" typically encountered there. To make room for these expansions, the previously held workshops at the front-end of the week have all been moved to Sunday, with registration opening on Saturday afternoon. Workshops will also be presented on Friday to close the week. In between, there is an extensive menu of activities, both technical and social, to satisfy everyone. Box lunches are available at the noontime panel sessions to simplify the luncheon scramble. The plenary session will start at mid-morning Tuesday. Focused sessions will be folded into the schedule, providing a little different type of presentation on specially selected subjects.

The Radio Frequency Integrated Circuits (RFIC) Symposium and Automatic Radio Frequency Techniques Group (ARFTG) Conference is held in conjunction with the 1999 IMS. RFIC is on Monday with some joint sessions with IMS on Tuesday, and ARFTG is on Friday with joint sessions on Thursday.

As of press time a record number of exhibitors had signed up (>620), all prepared to show off their products from Tuesday through Thursday. To supplement the exhibits are the Microwave Applications Seminars, popular vendor specific talks which give more in-depth information on particular subjects. Don't forget the Historical Exhibit which provides an interesting look into our Society's past.

There is more to the Symposium than the technical program and exhibitors. Social events include the Microwave Journal/MTT-S Reception on Monday, the MTT-S Awards Banquet and the Industry-Hosted Cocktail Reception on Wednesday. Six guest tours are planned for local diversion as well, running Sunday through Thursday. And there's always the beach, Disneyland and other attractions for those who get burnt out on "noise figure vs. gain." So, take this opportunity to share with friends your break from the workday routine. Re-acquaint or make some new friends along with all of the hi-tech happenings.

Robert L. Eisenhart  
General Chairman  
1999 International Microwave Symposium

**1999 IEEE MTT-S**  
**INTERNATIONAL MICROWAVE**  
**SYMPOSIUM DIGEST**

*Symposium Steering Committee*  
*Technical Program Committee*  
*Administrative Committee*  
*RFIC Committees*  
*and ARFTG Committee*

**1999 IEEE MTT-S International Microwave Symposium**



**JUNE 13-19, 1999 • ANAHEIM CALIFORNIA**

# 1999 Symposium Steering Committee

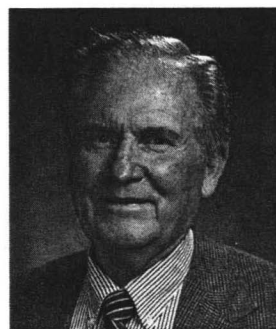
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## Steering Committee

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Robert L. Eisenhart  
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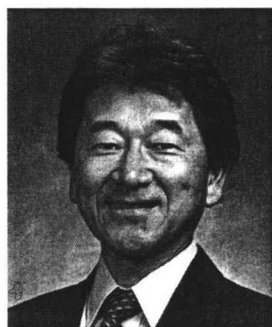


John B. Horton  
Vice Chair

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H. John Kuno  
Chair



Madhu S. Gupta  
Vice Chair

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## Publications

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# 1999 Symposium Steering Committee

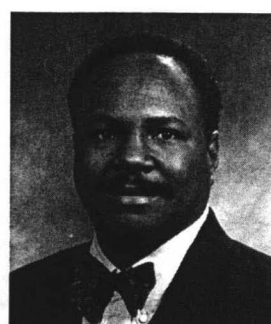
## Special Sessions



Rick Sturdivant  
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Chic Shishido  
Vice Chair

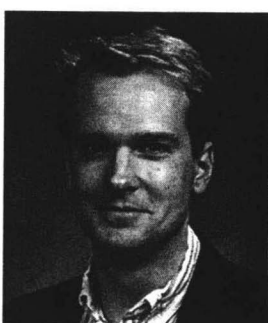


Hector J. De Los Santos

## Workshops



Jitendra Goel

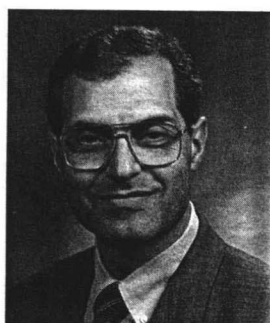


Carl Pobanz



Young Ma

## Interactive Forum



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Chair



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## Focused Sessions

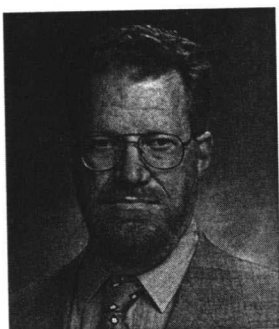


Arvind Sharma



# 1999 Symposium Steering Committee

## Publicity

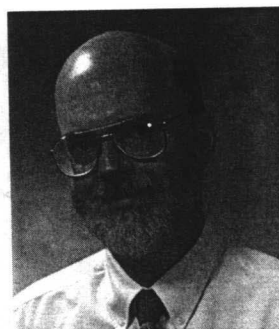


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Chair



Terry Cisco  
Vice Chair

## Webwright



Steve Maas

## Student Papers

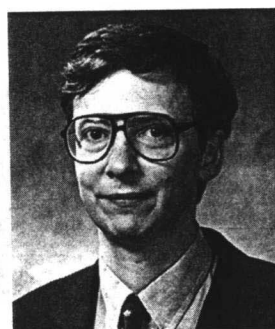


Paul Yu  
Chair



Upkar Dhaliwal

## Transactions Special Issue



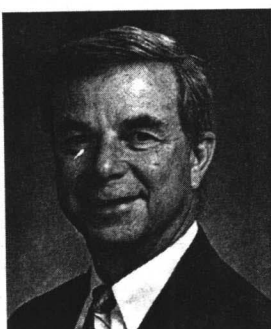
David Rutledge

## Local Arrangements



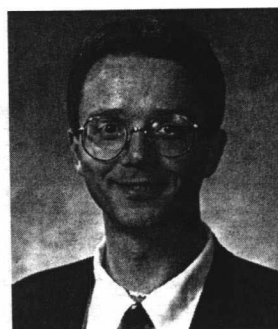
J. K. McKinney  
Chair

## Convention Signs



Pete Pusateri

## Day Book



Bela Szendrenyi



# 1999 Symposium Steering Committee

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## Protocol

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Nancy Eisenhart  
Chief



Yuki Kuno  
Awards



Mary Jacobs  
Banquet



Hilda Kanber  
Photography



Laura Wen  
Chair, Special Events



Chuck Swift  
Special Events

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## Finance

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Charlie Jackson  
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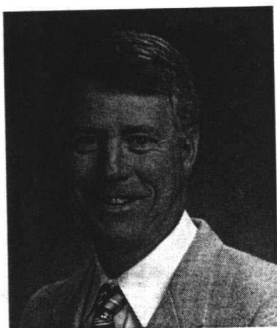
Ed Rezek  
Vice Chair



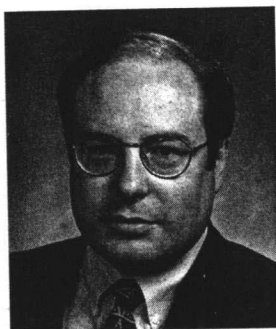
Daniel Ko

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## Registration



Phil Arnold  
Chair



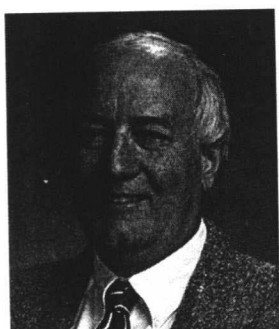
Jim Weiler

## Guest Program



Julie Maas

## Special and Historical Exhibits



H. Clark Bell  
Chair



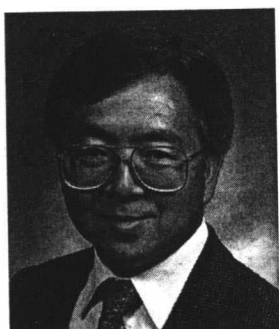
Harvey Endler



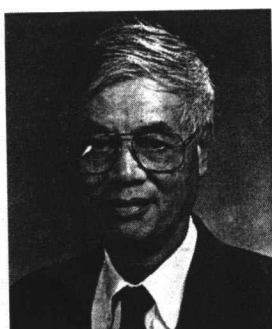
Lawrence Williams

## $\mu$ APS

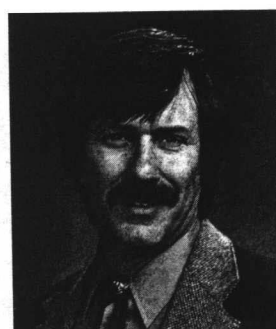
## Liaisons



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RFIC



Cheng P. Wen  
RFIC



Gary Simpson  
ARFTG

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Don Parker



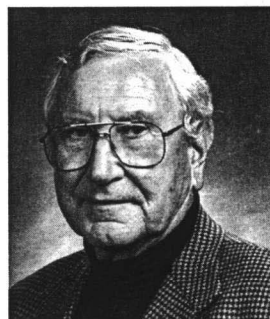
Reynold Kagiwada

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## Members at Large



George Oltman



Alvin Clavin

## Conference Services



Larry Whicker

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## Exhibition



Howard Ellowitz



Harlan Howe Jr.

# 1999 Symposium Steering Committee



Other Steering Committee Members not shown

John Davis, University Liaison

Mike Finnegan, Registration

Russell Gaspari, Special Exhibits

Mike Majerus, Local Arrangements

Carolyn Parker, Protocol, Social Printing

Gary Peale, Local Arrangements

Rohit Raja, Finance

Don Stinson, Local Arrangements



Mario A. Maury, Jr.

## Honorary Steering Committee Member

As the original General Chairman, Mario Maury was the one who proposed and brought the 1999 International Microwave Symposium to Anaheim. He died unexpectedly in March, 1995. At the time he was Vice President of the MTT-S Administrative Committee and a strong contributor in many MTT activities. We regret the missed opportunity of working with Mario on this Symposium.

# Message from the 1999 Technical Program Chairs

We welcome you to the 1999 IEEE MTT-S International Microwave Symposium, to Southern California, and to a week of **the Magic Touch of Microwaves**.

The technical program this year promises to uphold the excellence that has made it a hallmark of the International Microwave Symposium each year. Leaders in the field will describe new breakthroughs and provide authoritative overviews of the status of specific technologies and of the state of the art in specific areas of RF and microwave technologies. This year we introduce a number of new features in the technical program. Interactive Forums are expanded into three afternoons, each forum organized into small groups by topic for individual in-depth discussions with authors. Podium presentation sessions are expanded to four days in response to burgeoning paper submissions and increasing audience interest, allowing a record number of papers, and, more importantly, more full length papers than ever before. Over 460 papers from all over the world will be presented in 65 podium sessions and 3 Interactive Forum Sessions.



**H. John Kuno**  
Chair

Those who are new to a field, as well as those who wish to survey progress in a particular area, can choose from more than 20 Workshops, led by speakers who have made contributions to the field and who are recognized for their expertise. Business issues and technical issues will be covered at noon-time Panel Sessions to provide ideas to all from budding entrepreneurs to business veterans who want to keep abreast of current trends. Emerging technologies and standards in design and fabrication will be presented in a Rump Session on multi-chip modules and a Panel Session on open-frame architecture. Developing technologies for the 21<sup>st</sup> century in high-data wireless communication will be highlighted in the



**Madhu S. Gupta**  
Vice Chair

Plenary Session, and Focus Sessions will follow this theme with speakers on remote sensing, low-cost processing, and technologies for increasing communication rates by orders of magnitude. A large part of these Special Sessions will deal with technology and business forecasts for the next century.

The Historical Session will be a special feature this year with historical milestones reached in Southern California described by speakers who have first-hand knowledge of events from earlier decades. Continuing the commitment to education by the IEEE Microwave Theory and Techniques Society, the program this year will include the student paper contest, student awards, and an RF and Microwave Education Forum. Hundreds of exhibitors will showcase their products and services at the world's largest Microwave Exhibit under one roof and, in Microwave Application Seminars, will present expository materials and updates in their respective technologies.

Above all, you will be able to renew old acquaintances, make new contacts, and network with the experts in every field of the microwave and RF technology. If we can be of any assistance, please contact us or any of the other volunteers who are eager to make the Symposium a truly worthwhile and enjoyable time well spent.

The 250 members of the 1999 Technical Program Committee and the 1999 Symposium Steering Committee worked diligently in organizing an excellent technical program. We would like to take this opportunity to acknowledge the work of the Technical Committee and thank the individual members of the Steering Committee for their support.

Technical Program Committee  
H. John Kuno, Chair  
Madhu S. Gupta, Vice Chair

# 1999 Technical Program Committee



**Symposium Steering Committee**

back row: J. K. McKinney, R. Eisenhart\*, S. Swift, G. Oltman  
H. Kanber, H. Ellowitz; front row: C. Jackson, N. Eisenhart  
H. Howe Jr., Y. Kuno; not shown: J. Wassel



**Symposium Steering Committee**

back row: R. Sturdivant, J. Horton, E. Ponti, M. S. Gupta  
K. Varian; front row: P. Yu, M. Matloubian, H. J. Kuno\*,  
S. M. Saad



**Symposium Steering Committee**

back row: C. P. Wen, L. Whicker, D. Rutledge, G. Thoren,  
G. Simpson; front row: C. Shishido, T. Lee, Y. Ma



**EM Field Analysis and Guided Waves**

back row: S. El-Ghazaly, P. Lampariello, J. Zehentner, T. K. Sarkar  
A. Omar, V. F. Hanna; front row: S.-T. Peng, A. A. Oliner\*,  
M. Salazar-Palma, N. K. Das



**EM Field Analysis Frequency Domain  
Numerical Methods**

back row: F. Arndt, J. Bornemann, D. Yang, J. Pekarek, A. Beyer  
front row: R. Sorrentino, L. Williams, J. Mink\*



**EM Field Analysis Time Domain  
Numerical Methods**

back row: W. Hoefer, R. Vahldieck, P. Russer\*, R. Pregla  
front row: W. Gwarek, L. Roselli

\*Chair or Co-chair



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## CAD Algorithms and Techniques

R. Biernacki, A. Sharma, J. Bandler, K. C. Gupta\*, B. Perlman  
not shown: M. Abouzahra, T. Rozzi



## CAD Oriented Models

back row: T. Shibata, A. Weisshaar, M. Dydyk, M. Mongiardo  
front row: I. Wolff\*, K. Chang



## Transmission Line and Passive Structures

T. Itoh\*, C. C. Tzuang, J. Owens, K. Wu, W. C. Tang  
not shown: M. Kitlinski, T. Yoneyama



## Passive Circuit Elements and Components

back row: R. Levy, E. Denlinger, A. Fathy, S. M. Saad, J. Taub  
front row: K. Zaki, T. Nishikawa, L. Katehi\*



## Filters and Multiplexers

back row: G. Matthaei, M. Guglielmi, D. Schmitt, D. Swanson,  
S. J. Fiedziuszko, P. Guillon; front row: A. Atia, R. Snyder\*,  
C. Kudsia; not shown: Y. C. Shih



## Ferrite and SAW Components

back row: B. McAvoy, W. E. Hord\*, D. Webb, R. Weigel,  
B. El Sharawy; front row: L. E. Davis, R. Kagiwada, J. D. Adam  
not shown: K. Anemogiannis, D. Malocha

\* Chair or Co-chair



# 1999 Technical Program Committee



## Superconducting Components

back row: R. Mansour, M. Lancaster, J. Pond, W. G. Lyons, M. Nisenoff\*; front row: G. C. Liang\*, S. Talisa, C. Jackson



## Devices and Circuits for Signal Generation and Amplification

back row: O. Llopis, J. F. Luy, R. Alm, M. Schindler\*, M. Tutt  
front row: P. Staecker, A. P. Khanna  
not shown: T. Oxley, D. Peterson



## Devices and Circuits for Digital-Analog Control and Frequency Conversion

back row: K. Wang, Y. Umeda, S. Brozovich, A. Truitt, C. Chang\*; front row: K. Honjo, J. Tsui, H. Boss, A. Oki  
not shown: B. Sigmon



## Nonlinear Device Modeling

back row: M. Calcaterra, R. Trew, W. Curtice\*, C. Snowden  
front row: M. Golio, D. Root, J. Hwang  
not shown: R. Pucel



## Nonlinear Microwave Circuits

back row: P. Draxler, S. Maas, M. Odyniec, D. Meharry  
front row: S. Kenney, V. Rizzoli, T. Brazil  
not shown: M. Steer\*



## Transistor Power Amplification

back row: J. Kuno, J. Heaton, P. Asbeck, J. Schellenberg, A. Platzker; front row: J. Degenford\*, M. Cohn, E. J. Crescenzi  
not shown: B. Bayraktaroglu

\* Chair or Co-chair

# 1999 Technical Program Committee



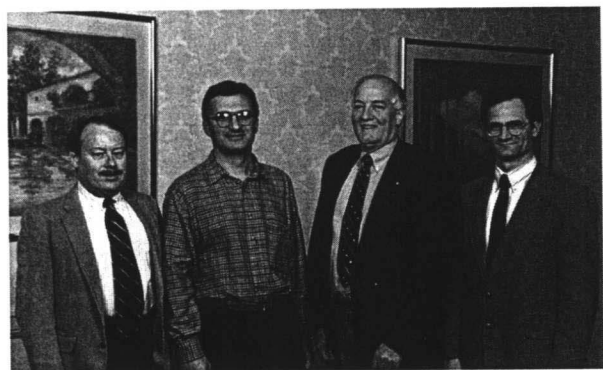
## Very High Power Components and Applications

back row: J. Goel\*, S. Stitzer, E. Griffin, F. Sechi, K. Ikossi-Anastasiou; not shown: M. Patel, D. Reid



## Low Noise Circuits and Components

back row: M. Pospieszalski, W. Wilson, P. Smith, R. Camisa, T. Cisco; front row: S. Weinreb, M. S. Gupta, E. Rezek; not shown: H. Okean, J. Whelehan\*



## HF, VHF, and UHF Technology

Fritz Raab\*, Murat Eron, H. Clark Bell, Rick Campbell  
not shown: Rolf Jansen



## Millimeter Wave and Submillimeter Wave Technologies

back row: M. Matlobian, J. W. Dees, E. Niehenke, A. Riddle, K. Agarwal; front row: N. Deo, J. Wiltse\*, W. Shiroma; not shown: P. Saunier



## Lightwave Technology

P. Matthews, A. Seeds, C. Gee, H. Sobol  
not shown: N. Dietrich\*, P. Herczfeld, D. Jeager, R. Knerr, C. Lee, A. Paoella



## Biological Effects and Medical Applications

G. D'Inzeo, R. Bansal, A. Vander Vorst, P. Yu  
not shown: K. Carr, A. Gopinath, A. Rosen\*, M. Stuchly

\* Chair or Co-chair

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