IEEE CONTROL For the Microwave & Wireless Engineer MAGAZINE

Volume 17 • Number 10 • October 2016

FROM
THE
PAST,

LOOKING to the FUTURE





Microwave Magazine and MTT Society Officers

Editor

Alfy Riddle, Kumu Networks, microwave.editor@ieee.org

Assistant Editor

Sharri Shaw, NIST, microedt@nist.gov

Associate Editors

Robert H. Caverly, Villanova University, Pennsylvania, United States robert.caverly@villanova.edu

Nuño Borges Carvalho, University of Aveiro, Portugal, nbcarvalho@ua.pt

Ana Collado, CTTC, Barcelona, Spain, ana.collado@cttc.cat

Simone Bastioli, RS Microwave, New Jersey, United States sbastioli@rsmicro.com

Ali Darwish, American University in Cairo, Egypt, ali@darwish.org

Luca Roselli, University of Perugia, Italy, urlofi@tin.it; luca.roselli@unipg.it

Anding Zhu, University College, Dublin, Ireland, anding.zhu@ucd.ie

Christian Fager, University of Chalmers, Sweden, christian.fager@chalmers.se

Mohammad S. Hashmi, Indraprastha Institute of Information Technology, Delhi, India, mshashmi@iiitd.ac.in

Almudena Suarez, University of Cantabria, Spain, almudena.suarez@unican.es

Columns and Departments

MicroBusiness

Fred Schindler, RF Micro Devices, m.schindler@ieee.org

Health Matters

James C. Lin, University of Illinois-Chicago, lin@uic.edu

Microwave Surfing

Rajeev Bansal, University of Connecticut, rajeev@engr.uconn.edu

Book Reviews

James Chu, Southern Polytechnic State University, Georgia, jchu@spsu.edu

Education Corner

Ramesh Gupta, Lightsquared, Washington, D.C., ramesh.gupta@ieee.org

Membership News

Bela Szendrenyi, Advantest, bela.szendrenyi@advantest.com

New Products

Ken Mays, KMays Technical Services, microwave.newproducts@ieee.org

In Memoriam Contributions

John T. Barr IV, j.barr@ieee.org

Ombuds Officer

Ed Niehenke, Niehenke Consulting, e.niehenke@ieee.org

IEEE Periodicals Magazines Department

Mark Gallaher, Managing Editor Janet Dudar, Senior Art Director Gail A. Schnitzer and Mark Morrissey, Associate Art Directors Theresa L. Smith, Production Coordinator Felicia Spagnoli, Advertising Production Manager Peter M. Tuohy, Production Director Dawn M. Melley, Editorial Director Fran Zappulla, Staff Director, Publishing Operations

Advertising Sales

Mark David, Sr. Manager Advertising & Business Development +1 732 465 6473, fax +1 732 981 1855

Digital Object Identifier 10.1109/MMM.2016.2589204



IEEE prohibits discrimination, harassment, and bullying. For more information, visit http://www.ieee. org/web/aboutus/whatis/policies/p9-26.html.

IEEE

Volume 17 • Number 10 • October 2016 • ISSN 1527-3342

features

28 Improving Radar's Spatial Recognition

A Radar Scanning Method Based on Microwave Spatial Spectral Illumination Moshe Mizrahi, Eldad Holdengreber, Shmuel E. Schacham, Eli Farber, and Zeev Zalevsky

35 Designing and Packaging **Wide-Band PAs**

Wideband PA Packaging, History, and Recent Advances: Part 1 Kamal K. Samanta

46 Echoing Across the Years

A History of Early Radar Evolution Tapan K. Sarkar, Magdalena Salazar Palma, and Eric L. Mokole



IEEE

IEEE Microwave Theory and Techniques Society

The IEEE Microwave Theory and Techniques Society (MTT-S) is an organization, within the framework of the IEEE, of members with principal professional interests in the field of microwave theory and techniques. All members of the IEEE are eligible for membership in the Society. Information about joining the IEEE or the Society is available on the Web, http://www.ieee.org/membership.

MTT-S AdCom

The Society is managed by an Administrative Committee (AdCom) consisting of 21 elected members of the Society plus additional ex-officio members as provided in the MTT-S Constitution and Bylaws, which is available on the Web, http://www.mtt.org.

Officers

President: President-Elect: Secretary: Treasurer:

Ke Wu Dylan Williams Maurizio Bozzi Alaa Abunjaileh

Elected Members

Alaa Abunjaileh Silvio Barbin Tom Brazil Ramesh Gupta Rashaunda Henderson Wei Hong Arne Jacob Shiban Koul Joy Laskar Tim Lee Gregory Lyons

Sergio Pacheco George Ponchak Sanjay Raman James Rautio Jose E. Rayas-Sanchez Steve Reising Magdalena Salazar-Palma Atsushi Sanada Dominique Schreurs Michael Steer

Ex Officio Members (with vote)

Immediate Past Presidents:

Mohammad Madihian

Tim Lee (2015) Robert Weigel (2014) Madhu Gupta (2013) Nick Kolias (2012)

Dylan Williams

Ke Wu

Honorary Life Members:

Tatsuo Itoh Richard Sparks Peter Staecker

IEEE Trans. Microwave Theory & Techniques Coeditors:

Jenshan Lin Dominique Schreurs

IEEE Microwave & Wireless Components Letters Editor: IEEÉ Microwave Magazine Editor: IEEE Trans. Terahertz Science &

N. Scott Barker Alfy Riddle

Technology Editor:

Jan Stake

IEEE Microwave Magazine (ISSN 1527-3342) (IEMMFF) is published monthly by the Institute of Electrical and Electronics Engineers, Inc. Headquarters: 3 Park Avenue, 17th Floor, New York, NY 10016-5997 USA. Responsibility for the contents rests upon the authors and not upon the IEEE, the Society, or its members. IEEE Service Center (for orders, subscriptions, address changes): 445 Hoes Lane, Piscataway, NJ 08854. Telephone: +1 732 981 0069, +1 800 678 4333. Individual copies: IEEE members US\$20.00 Telephone: +1 732 981 0060, +1 800 678 4333. Individual copies: IEEE members US\$20.00 (first copy only), nonmembers US\$32.00 per copy. Subscription rates: Subscriptions for Society members are included with membership dues. Nonmember subscription rates available upon request. Copyright and reprint permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limits of U.S. Copyright law for the private use of patrons those articles that carry a code at the bottom of the first page, provided the per-copy fee is paid through the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923 USA. For other copying, reprint, or republication permission, write Copyrights and Permissions Department, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854 USA. Copyright © 2016 by the Institute of Electrical and Electronics Engineers, Inc. All rights reserved. Periodicals postage paid at New York, N.Y., and at additional mailing offices. Ride along enclosed. Postmaster: Send address changes to IEEE Microuww Magazine, IEEE Operations Center, 445 Hoes Lane, Piscataway, NJ 08854 USA. Canadian GST #125634188

PRINTED IN THE USA

Digital Object Identifier 10.1109/MMM.2016.2589205

Digital Object Identifier 10.1109/MMM.2016.2589205

columns & departments

- From the Editor's Desk Alfy Riddle What's Important to a Magazine?
- President's Column Ke Wu Self-Coupling, Mutual Coupling, Decoupling, and Coupling of Our Technical Fields of Interest
- Microwave Surfing Rajeev Bansal Shielded No More?
- 21 Health Matters

 James C. Lin Changing the Conversation on Cell Phone RF Radiation Carcinogenesis
- 24 MicroBusiness
 Fred Schindler Different Perspectives
- **Application Notes**
 - Jim Carroll, Gent Paparisto, and David Vye The "Coffee-Can" Radar Redesigned as an Inexpensive RF PCB
- Conference Report
 - Andy Gibson and Rob Sloan Experience EuMW 2016 in London, United Kingdom
- **Book/Software Reviews**
 - James Chu

Fundamentals of Digital Communications

80 In Memoriam

Nathan (Nat) Sokal

Yevgeny Mitrofanovich Kuleshov

- 83 MTT-S Society News
 - Ramesh K. Gupta

Industry Best Papers Recognized at IMS2016, San Francisco

- Around the Globe 88
 - Jan Macháč

2016 MTT-S Region 8 Chapter Chair Meeting

- Conference Calendar
- Enigmas, etc.
 - Takashi Ohira

Two-Port S-Parameters