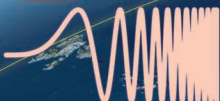


IEEE

microwave

for the Microwave & Wireless Engineer



MAGAZINE

Volume 22 • Number 4 • April 2021

Microwaves in China



Editor

Robert H. Caverly, Villanova University,
Pennsylvania, USA, microwave.editor@ieee.org

Assistant Editor

Sharri Shaw, JWM Consulting LLC, USA,
microedt@outlook.com

Associate Editors

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

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

Chia-Chan Chang, National Chung-Cheng
University, Taiwan, ccchang@ee.ccu.edu.tw

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

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

Jianguo Ma, Guangdong University of
Technology, China, mjg@gdut.edu.cn

Alfy Riddle, Quanergy Systems, Inc., Sunnyvale,
California, USA, alfred.riddle@quanergy.com

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

Kamal Samanta, Sony Europe, U.K.,
kmlsamanta@googlemail.com

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

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

Columns and Departments

MicroBusiness

Fred Schindler, Newtonville, Massachusetts,
USA, m.schindler@ieee.org

Health Matters

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

Microwave Surfing

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

Book Reviews

James Chu, Kennesaw State University, Marietta,
Georgia, USA, jameschu@bellsouth.net

Education Corner

Rashaunda Henderson, University of Texas
Dallas, Texas, USA, mh072000@utdallas.edu

Women in Microwaves

Wenquan Che, Nanjing University of Science
and Technology, China, yeeeren_che@163.com

Membership News

Bela Szendrenyi, Advantest, San Jose, California,
USA, bela.szendrenyi@advantest.com

New Products

Ken Mays, The Boeing Company, Washington,
USA, microwave.newproducts@ieee.org

In Memoriam Contributions

Jerry Hausner, USA, j.hausner@ieee.org

Ombuds Officer

Edward C. Niehenke, Niehenke Consulting,
USA, e.niehenke@ieee.org

IEEE Periodicals Magazines Department

Mark Gallaher, Managing Editor

Geraldine Krolin-Taylor, Senior Managing Editor

Janet Dudar, Senior Art Director

Gail A. Schnitzer, Associate Art Director

Theresa L. Smith, Production Coordinator

Felicia Spagnoli, Advertising Production Manager

Peter M. Tuohy, Production Director

Kevin Lisankie, Editorial Services Director

Dawn Melley, Senior Director, Publishing Operations

Advertising Sales

Mark David, Director, Business Development—
Media & Advertising
+1 732 465 6473, fax +1 732 981 1855

Digital Object Identifier 10.1109/MMM.2020.3047744



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



Volume 22 • Number 4 • April 2021 • ISSN 1527-3342

features

18 A Review of Microwave Vacuum Devices in China

Theory and Device Development Including High-Power Klystrons, Spaceborne TWTs, and Gyro-TWTs
Jirun Luo, Jinjun Feng, and Yubin Gong

34 Research on GaN-Based RF Devices

High-Frequency Gate Structure Design, Submicrometer-Length Gate Fabrication, Suppressed SCE, Low Parasitic Resistance, Minimized Current Collapse, and Lower Gate Leakage
Yue Hao, Xiaohua Ma, Minhan Mi, and Lin-An Yang

49 Recent Progress in SISL Circuits and Systems

Review of Passive and Active Circuits Demonstrating SISL's Low Loss and Self-Packaging and Showcasing the Merits of Metallic, Shielded, Suspended Lines
Kaixue Ma, Ningning Yan, and Yongqiang Wang



on the cover:

©SHUTTERSTOCK.COM/HARVEPINO

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: Gregory Lyons
President-Elect: Rashaunda Henderson
Secretary: Joseph Bardin
Treasurer: Maurizio Bozzi

Elected Members

Scott Barker	Sherry Hess
Maurizio Bozzi	Sridhar Kanamaluru
Nuno Borges Carvalho	Dietmar Kissinger
Robert H. Caverly	Gregory Lyons
Goutam Chattopadhyay	Raafat Mansour
Wenquan Che	Daniel Pasquet
Terry Cisco	Ajay Poddar
Kamran Ghorbani	José Rayas-Sanchez
Xun Gong	Peter Siegel
Ramesh Gupta	Anding Zhu
Rashaunda Henderson	

Ex-Officio Members

Immediate Past Presidents:

Alaa Abunjaileh* (2020)
Dominique Schreurs* (2018–2019)
Dylan Williams* (2017)

Honorary Life Members
(max. three votes):*

Józef Modelski
John T. Barr IV
Tatsuo Itoh
Richard Sparks
Peter Staecker

MTT-S Publications

<i>IEEE Trans. Microwave Theory & Techniques</i> Editor:	Jianguo Ma*
<i>IEEE Microwave & Wireless Components Letters</i> Editor:	Thomas Zwick*
<i>IEEE Microwave Magazine</i> Editor:	Robert H. Caverly
<i>IEEE Trans. Terahertz Science & Technology</i> Editor:	Imran Mehdi*
<i>IEEE Journal of Electromagnetics, RF, and Microwaves in Medicine and Biology</i> Editor:	Yongxin Guo
<i>IEEE Journal on Multiscale and Multiphysics Computational Techniques</i> Editor:	Costas Sarris
<i>IEEE Journal of Microwaves</i> Editor:	Peter Siegel

*Indicates voting AdCom ex-officio member

IEEE Microwave Magazine (ISSN 1527-3342) (IEMMFF) is published 12 times a year 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 0060, +1 800 678 4333. Individual copies: IEEE members US\$20.00 (first copy only), nonmembers US\$37.00 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 © 2021 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 Microwave Magazine*, IEEE Operations Center, 445 Hoes Lane, Piscataway, NJ 08854 USA. Canadian GST #125634188
PRINTED IN THE USA

Digital Object Identifier 10.1109/MMM.2020.3047745

columns & departments

6 From the Editor's Desk

■ Robert H. Caverly
Welcome to the April Issue!

10 President's Column

■ Gregory Lyons
We Are MTT

12 MicroBusiness

■ Fred Schindler
Success and Failure Part 2: The Perils of Success

13 Health Matters

■ James C. Lin
New ICEMAN Project Seeks Answers to Fighter Pilot Disorientation

16 From the Guest Editor's Desk

■ Kaixue Ma
Microwaves in China

76 Book/Software Reviews

■ Nader Engheta
Survey of Electromagnetic Field and Wave Interaction With "Surfaces"

■ James Chu
Bridging the Gap Between Electromagnetic Theory and Application

79 Women in Microwaves

■ Ye Han
Embrace the Change Together: WiM Event at NEMO 2020

81 MTT-S Society News

■ Nuño Borges Carvalho and Robert H. Caverly
Spotlight on the MTT-S Membership and Geographic Activities Committee

84 MTT-S Ombuds Officer

■ Edward C. Niehenke

88 Enigmas, etc.

■ Takashi Ohira
Quadrature Current

92 Conference Calendar