

APPLIED COMPUTATIONAL ELECTROMAGNETICS SOCIETY JOURNAL

November 2024

Vol. 39 No. 11

ISSN 1054-4887

The ACES Journal is abstracted in INSPEC, in Engineering Index, DTIC, Science Citation Index Expanded, the Research Alert, and to Current Contents/Engineering, Computing & Technology.

The illustrations on the front cover have been obtained from the ARC research group at the Department of Electrical Engineering, Colorado School of Mines

Published, sold and distributed by: River Publishers, Alsbjergvej 10, 9260 Gistrup, Denmark

THE APPLIED COMPUTATIONAL ELECTROMAGNETICS SOCIETY
<http://aces-society.org>

EDITORS-IN-CHIEF

Atef Elsherbeni
Colorado School of Mines, EE Dept.
Golden, CO 80401, USA

Sami Barmada
University of Pisa, ESE Dept.
56122 Pisa, Italy

ASSOCIATE EDITORS

Mauro Parise
University Campus Bio-Medico of Rome
00128 Rome, Italy

Wei-Chung Weng
National Chi Nan University, EE Dept.
Puli, Nantou 54561, Taiwan

Luca Di Rienzo
Politecnico di Milano
20133 Milano, Italy

Yingsong Li
Harbin Engineering University
Harbin 150001, China

Alessandro Formisano
Seconda Università di Napoli
81031 CE, Italy

Lei Zhao
Jiangsu Normal University
Jiangsu 221116, China

Riyadh Mansoor
Al-Muthanna University
Samawa, Al-Muthanna, Iraq

Piotr Gas
AGH University of Science and Technology
30-059 Krakow, Poland

Sima Noghanian
Commscope
Sunnyvale, CA 94089, USA

Giulio Antonini
University of L Aquila
67040 L Aquila, Italy

Long Li
Xidian University
Shaanxa, 710071, China

Nunzia Fontana
University of Pisa
56122 Pisa, Italy

Antonino Musolino
University of Pisa
56126 Pisa, Italy

Steve J. Weiss
US Army Research Laboratory
Adelphi Laboratory Center (RDRL-SER-M)
Adelphi, MD 20783, USA

Stefano Selleri
DINFO - University of Florence
50139 Florence, Italy

Abdul A. Arkadan
Colorado School of Mines, EE Dept.
Golden, CO 80401, USA

Jiming Song
Iowa State University, ECE Dept.
Ames, IA 50011, USA

Fatih Kaburcuk
Sivas Cumhuriyet University
Sivas 58140, Turkey

Mona El Helbawy
University of Colorado
Boulder, CO 80302, USA

Santanu Kumar Behera
National Institute of Technology
Rourkela-769008, India

Huseyin Savci
Istanbul Medipol University
34810 Beykoz, Istanbul

Sounik Kiran Kumar Dash
SRM Institute of Science and Technology
Chennai, India

Daniele Romano
University of L Aquila
67100 L Aquila, Italy

Zhixiang Huang
Anhui University
China

Vinh Dang
Sandia National Laboratories
Albuquerque, NM 87109, USA

Alireza Baghai-Wadji
University of Cape Town
Cape Town, 7701, South Africa

Marco Arjona López
La Laguna Institute of Technology
Torreon, Coahuila 27266, Mexico

Ibrahim Mahariq
Gulf University for Science and Technology
Kuwait

Kaikai Xu
University of Electronic Science
and Technology of China
China

Sheng Sun
University of Electronic Science and
Tech. of China
Sichuan 611731, China

Wenxing Li
Harbin Engineering University
Harbin 150001, China

Maria Evelina Mognaschi
University of Pavia
Italy

Qiuhua Huang
Colorado School of Mines
USA

Sihua Shao
EE, Colorado School of Mines
USA

EDITORIAL ASSISTANTS

Matthew J. Inman
University of Mississippi, EE Dept.
University, MS 38677, USA

Shanell Lopez
Colorado School of Mines, EE Dept.
Golden, CO 80401, USA

EMERITUS EDITORS-IN-CHIEF

Duncan C. Baker
EE Dept. U. of Pretoria
0002 Pretoria, South Africa

Allen Glisson
University of Mississippi, EE Dept.
University, MS 38677, USA

Ahmed Kishk
Concordia University, ECS Dept.
Montreal, QC H3G 1M8, Canada

Robert M. Bevensee
Box 812
Alamo, CA 94507-0516

Ozlem Kilic
Catholic University of America
Washington, DC 20064, USA

David E. Stein
USAF Scientific Advisory Board
Washington, DC 20330, USA

EMERITUS ASSOCIATE EDITORS

Yasushi Kanai
Niigata Inst. of Technology
Kashiwazaki, Japan

Mohamed Abouzahra
MIT Lincoln Laboratory
Lexington, MA, USA

Alexander Yakovlev
University of Mississippi, EE Dept.
University, MS 38677, USA

Levent Gurel
Bilkent University
Ankara, Turkey

Sami Barmada
University of Pisa, ESE Dept.
56122 Pisa, Italy

Ozlem Kilic
Catholic University of America
Washington, DC 20064, USA

Erdem Topsakal
Mississippi State University, EE Dept.
Mississippi State, MS 39762, USA

Alistair Duffy
De Montfort University
Leicester, UK

Fan Yang
Tsinghua University, EE Dept.
Beijing 100084, China

Rocco Rizzo
University of Pisa
56123 Pisa, Italy

Atif Shamim
King Abdullah University of Science and
Technology (KAUST)
Thuwal 23955, Saudi Arabia

William O'Keefe Coburn
US Army Research Laboratory
Adelphi, MD 20783, USA

Mohammed Hadi
Kuwait University, EE Dept.
Safat, Kuwait

Amedeo Capozzoli
Univerita di Naoli Federico II, DIETI
I-80125 Napoli, Italy

Maokun Li
Tsinghua University
Beijing 100084, China

Lijun Jiang
University of Hong Kong, EEE Dept.
Hong, Kong

Shinishihiro Ohnuki
Nihon University
Tokyo, Japan

Kubilay Sertel
The Ohio State University
Columbus, OH 43210, USA

Salvatore Campione
Sandia National Laboratories
Albuquerque, NM 87185, USA

Toni Bjorninen
Tampere University
Tampere, 33100, Finland

Paolo Mezzanotte
University of Perugia
I-06125 Perugia, Italy

Yu Mao Wu
Fudan University
Shanghai 200433, China

Amin Kargar Behbahani
Florida International University
Miami, FL 33174, USA

Laila Marzall
University of Colorado, Boulder
Boulder, CO 80309, USA

Qiang Ren
Beihang University
Beijing 100191, China

EMERITUS EDITORIAL ASSISTANTS

Khaleb ElMaghoub
Trimble Navigation/MIT
Boston, MA 02125, USA

Kyle Patel
Colorado School of Mines, EE Dept.
Golden, CO 80401, USA

Christina Bonnington
University of Mississippi, EE Dept.
University, MS 38677, USA

Anne Graham
University of Mississippi, EE Dept.
University, MS 38677, USA

Madison Lee
Colorado School of Mines, EE Dept.
Golen, CO 80401, USA

Allison Tanner
Colorado School of Mines, EE Dept.
Golden, CO 80401, USA

Mohamed Al Sharkawy
Arab Academy for Science and Technology, ECE Dept.
Alexandria, Egypt

NOVEMBER 2024 REVIEWERS

Adrian Amor-Martin
Ravi Kumar Arya
Hanish Chaitanya Bodepudi
Halim Boutayeb
Boguslaw Butrylo
Yuanxi Cao
Goga Cvetkovski
Thippesha D.
Taha Imeci
Tu-Lu Liang
Matteo Bruno Lodi

Vinoth M.
Maria Evelina Mognaschi
Rajesh Natarajan
Hatem Oday
Mahdi Oliaei
Ehsan Akbari Sekehravani
Varun Singh
Wen Yu
Xiaoyan Zhang
Theodoros Zygidis

TABLE OF CONTENTS

A Local Transition Adaptive Structured Mesh Generation Method for Finite Difference Time Domain Simulation
Zixuan Cao, Chunhui Mou, Chenghao Wang, Juan Chen, Shaolong Li, Cuirong Zhao, and Yuemeng Yin 936

Introduction of Incidence Wave using Generalized TF/SF for FDTD Analysis of Layered Media
Chao Yang, Haiyan Xie, Hailiang Qiao, Xinyang Zhai, Zaigao Chen, and Yinjun Gao 944

Time-domain Hybrid Method for the Coupling Analysis of Curved Power Lines Illuminated by Early-time High-altitude Electromagnetic Pulse
Zhihong Ye, Zhiwei Gao, Guangzhi Hong, Chen Tong, Ziran Ji, and Zeyu Xiao 952

A Dual-input Electromagnetic Inverse Scattering Algorithm Based on Improved U-net
Chun Xia Yang, Jun Jie Meng, Shuang Wei, and Mei Song Tong 961

Accelerated Extraction of Parasitic Capacitance in Metal Interconnects using Floating Random Walk Method
Dongyan Zhao, Yanning Chen, Fang Liu, Yang Zhao, Yali Shao, Dong Zhang, Yucheng Pan, and Xiangyu Meng 970

A Wideband High Front-to-Back Ratio Directional Filtering Slot Antenna and its Application in MIMO Terminals
Hailong Yang, Haitian Liu, Xuping Li, Yapeng Li, Shanzhe Wang, Jinsheng Zhang, Chenhao Wang, and Yun Fang 980

A Transparent Ultra-wideband Antenna Fed by CPW Based on Characteristic Mode Theory
Wanying Ren, Zhonggen Wang, Wenyan Nie, Weidong Mu, Chenlu Li, and Mingqing Wang 987

Butler Matrix Components Based on Substrate Integrated Waveguide Fed by Microstrip Separation Feedline for 5G Application
Yaqdhan Mahmood Hussein, Noor Asniza Murad, Mohamad Kamal A. Rahim, and Hatem Oday Hanoosh 999

Optimization of Receiver Optics for Radio Astronomy Kim Ho Yeap, Mey Chern Loh, Peh Chiong Teh, and Veerendra Dakulagi	1012
Optimizing Multi-coil Integrated High-speed On/Off Valves for Enhanced Dynamic Performance with Voltage Control Strategies Shuai Huang and Hua Zhou	1019