

APPLIED COMPUTATIONAL ELECTROMAGNETICS SOCIETY JOURNAL

April 2022
Vol. 37 No. 4
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

Maokun Li
Tsinghua University
Beijing 100084, China

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

Yingsong Li
Harbin Engineering University
Harbin 150001, China

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

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

Shinishiro Ohnuki
Nihon University
Tokyo, Japan

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

Giulio Antonini
University of L Aquila
67040 L Aquila, Italy

Antonio Musolino
University of Pisa
56126 Pisa, Italy

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

Salvatore Campione
Sandia National Laboratories
Albuquerque, NM 87185, USA

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

Alessandro Formisano
Seconda Universita di Napoli
81031 CE, Italy

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

Long Li
Xidian University
Shaanxa, 710071, China

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

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

Toni Björninien
Tampere University
Tampere, 33100, Finland

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

Daniele Romano
University of L Aquila
67100 L Aquila, Italy

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

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

Paolo Mezzanotte
University of Perugia
I-06125 Perugia, Italy

Luca Di Rienzo
Politecnico di Milano
20133 Milano, Italy

Lei Zhao
Jiangsu Normal University
Jiangsu 221116, China

Sima Noghaniān
Commscope
Sunnyvale, CA 94089, USA

Qiang Ren
Beihang University
Beijing 100191, China

Nunzia Fontana
University of Pisa
56122 Pisa, Italy

Stefano Selleri
DINFO - University of Florence
50139 Florence, Italy

Yu Mao Wu
Fudan University
Shanghai 200433, China

Fatih Kaburcuk
Sivas Cumhuriyet University
Sivas 58140, Turkey

Huseyin Savci
Istanbul Medipol University
34810 Beykoz, Istanbul

Zhixiang Huang
Anhui University
China

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

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

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

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

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

Wenxing Li
Harbin Engineering University
Harbin 150001, China

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

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

Christina Bonnigton
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 Academby for Science and Technology, ECE Dept.
Alexandria, Egypt

APRIL 2022 REVIEWERS

**Hristos T. Anastassiu
Thomas Bauernfeind
Behrokh Beiranvand
Arkaprovo Das
Nebojsa Doncov
Asma Ejaz
Mohamed Hameed
Zi He
Mohamed Khalifa
Arvind Kumar
Wang-Sang Lee
Fabrizio Loreto**

**Daniel Marcsa
Anton Menshov
Nitin Saluja
Khalil Sayidmarie
Surinder Singh
Margarita Tecpoyotl-Torres
Hamid Torpi
Yunus Uzun
Marsellas Waller
Chao-Fu Wang
Salah I. Yahya
Shihyuan Yeh**

THE APPLIED COMPUTATIONAL ELECTROMAGNETICS SOCIETY JOURNAL

Vol. 37 No. 4

April 2022

TABLE OF CONTENTS

Field Distribution Analysis Based on Improved Differential Algorithm for Dual Port Radiation Device Shiqi Wang, Shaojun Fang, and Peng Chen	373
Complementary Frequency Selective Surface with Polarization Selective Responses Jian Jiao, Nianxi Xu, and Jinsong Gao.....	382
The Spatial Distributions of Radiation Emitted from a Sinusoidal Current Filament and a Dipole Antenna Edmund K. Miller.....	388
3D Dynamic Ray-tracing Propagation Model with Moving Scatterer Effects Gang Liu, Tao Wei, and Chong-Hu Cheng	396
Study on Wide-angle Scanning Characteristics of Hemispherical Array Linqian Du, Jianping Zhao, and Juan Xu	403
Metasurface Superstrate-based MIMO Patch Antennas with Reduced Mutual Coupling for 5G Communications Sthembile P. Dubazane, Pradeep Kumar, and Thomas J. O. Afullo.....	408
A Novel Double-layer Low-profile Multiband Frequency Selective Surface for 4G Mobile Communication System Şakir Balta and Mesut Kartal	420
Application of the Multi-element Grid in EMC Uncertainty Simulation Jinjun Bai, Kaibin Guo, Jingchao Sun, and Ning Wang	428
Modeling the Insertion Loss of Structured Ethernet Cabling Standard using the Scattering Parameters Olusegun Ogundapo and Charles Nche	435
A Novel Wideband and Multi-band Implantable Antenna Design for Biomedical Telemetry Mohamed Behih, Farid Bouttout, Tarek Fortaki, and Christophe Dumond	441

A Compact Planar Monopole UWB MIMO Antenna Design with Increased Isolation for Diversity Applications S. Kolangiammal, L. Balaji, and G. Vairavel	458
Dynamic Force Calculation and Experimental Verification of Axial Bearings Mingqi Wang, Jingjing Zhao, Xingnan Liu, Ni Mo, and Zhengang Shi	466
Substrate Integrated Waveguide Antenna at Millimeter Wave for 5G Application Yaqdhan Mahmood Hussein, Mohamad Kamal A. Rahim, Noor Asniza Murad, Hatem Oday Hanoosh, and Norsaidah Binti Muhamad Nadzir	478
Research on EMI of Traction Network Transient Current Pulse on Shielded Cable Terminal Load Yingchun Xiao, Feng Zhu, Shengxian Zhuang, and Yang Yang	485
Analysis of Symmetric Two and Four-coil Magnetic Resonant Coupling Wireless Power Transfer Azuwa Ali, Mohd Najib Mohd Yasin, Ali Hanafiah Rambe, Ismahayati Adam, Nurulazlina Ramli, Hasliza A. Rahim, Thennarasan Sabapathy, Mohd Natasha Norizan, and Sharizal A. Sobri	497
Analysis of a Sinusoidal Rotor Segments Axial Flux Interior Permanent Magnet Synchronous Motor with 120-degree Phase Belt Toroidal Windings Yansong Wang, Wenbing Zhang, Rui Nie, Jikai Si, Wenping Cao, and Yingsheng Li	507