

IEEE
**VEHICULAR
TECHNOLOGY** MAGAZINE

Connecting the Mobile World

JUNE 2016
VOLUME 11 NUMBER 2
www.vtsociety.org

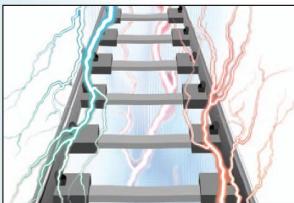
The Future of European Trains
Signaling, Control, and Protection

IEEE
VTS

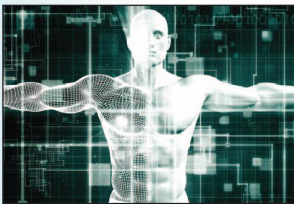
 **IEEE**

IEEE VEHICULAR TECHNOLOGY MAGAZINE

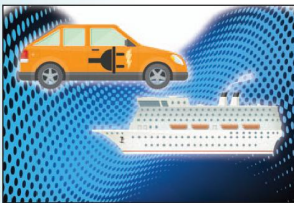
Connecting the Mobile World



Interpreting Calculations for Real-Life Conditions and Determining Appropriate Safety Margins
pp. 24–31



Steps Toward the Next Generation of Implantable Devices
pp. 32–42



Differences and Similarities Among the In-Car and the In-Ship Scenarios
pp. 43–51

Cover image: ©ISTOCKPHOTO.COM/RICH LEGG

FEATURES

- 24 Stray Current Calculation and Monitoring in DC Mass-Transit Systems**
Interpreting Calculations for Real-Life Conditions and Determining Appropriate Safety Margins
Charalambos A. Charalambous, Pete Aylott, and David Buxton
- 32 In Vivo Communications**
Steps Toward the Next Generation of Implantable Devices
Ali Fatih Demir, Z. Esad Ankarali, Qammer H. Abbasi, Yang Liu, Khalid Qaraqe, Erchin Serpedin, Huseyin Arslan, and Richard D. Gitlin
- 43 In-Vehicle Power Line Communication**
Differences and Similarities Among the In-Car and the In-Ship Scenarios
Alberto Pittolo, Marco de Piante, Fabio Versolatto, and Andrea M. Tonello
- 52 A Step Up in European Rail Traffic-Management Systems**
A Seamless Fail Recovery Scheme
Igor Lopez, Marina Aguado, and Christian Pinedo
- 60 Ensuring Long-Term Data Integrity**
ETCS Data Integrity Requirements Can Be Fulfilled Even under Unfavorable Conditions with the Proper LTE Mechanisms
Aleksander Sniady, José Soler, Mohamed Kassab, and Marion Berbineau
- 71 UltraDense Networks**
The New Wireless Frontier for Enabling 5G Access
Antonis G. Gotsis, Stelios Stefanatos, and Angeliki Alexiou

Digital Object Identifier 10.1109/MVT.2016.2541579

COLUMNS

- 3 From the Editor
- 4 President's Message
- 5 Mobile Radio
- 14 Transportation Systems
- 19 Connected Vehicles
- 79 Standards

DEPARTMENT

- 82 Calendar of Events

VEHICULAR TECHNOLOGY MAGAZINE STAFF

Klaus David—Editor-in-Chief

University of Kassel
Wilhelmshöher Allee 73
34121 Kassel - Germany
Tel: +49 - 561 - 804 - 6314
david@uni-kassel.de

SENIOR EDITORS

Automotive Electronics

William J. Fleming, TRW (retired), IEEE VTS
wfleming@wowway.com

Vijay Garg, Ford (retired), IEEE VTS
garg.vjay@gmail.com

Mobile Radio

Javier Gozalvez, University Miguel Hernández
jgozalvez@ieee.org

Standards

Otman A. Al-Basir, University of Waterloo
otman.basir@gmail.com

Transportation Systems

Harvey M. Glickenstein, WSP | Parsons Brinckerhoff
h.glickenstein@ieee.org

Connected Vehicles

Elisabeth Uhleman, Malardalen University, Sweden
elisabeth.uhlemann@mdh.se

Bih Yuan Ku, National Taipei University of Technology
b.y.ku@ieee.org

ASSOCIATE EDITORS

Edward Au, Marvell Semiconductor, Inc.

Dennis Bodson, IEEE VTS

Claudio Casetti, Politecnico di Torino, Italy

Alex Grant, University of South Australia

Hsiao-Hwa Chen, National Sun Yat-Sen University

John Kenney, Toyota Info Technology Center

Matthias Pätzold, University of Agder, Norway

Jordi Pérez-Romero, Technical University of Catalonia

Miquel Sepulcre, University Miguel Hernández

EXECUTIVE COMMITTEE

Javier Gozalvez, President

Alexander Wyglinski, Executive Vice President

JR Cruz, Vice President—Conferences

Fabrice Labeau, Vice President—Membership

WeiHua Zhuang, Vice President—Publications

James M. Irvine, Secretary

Thomas N. Rubinstein, Treasurer

Tracy Fulghum, Senior Past President

IEEE PERIODICALS/MAGAZINES DEPARTMENT

Debby Nowicki, *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 Melley, *Editorial Director*

Fran Zappulla, *Staff Director, Publishing Operations*

IEEE prohibits discrimination, harassment, and bullying.

For more information, visit <http://www.ieee.org/web/aboutus/whatis/policies/p926.html>.

MISSION STATEMENT

The IEEE Vehicular Technology Society is an organization of members with professional interests in connecting the mobile world. Its principle technical areas include mobile radio, motor vehicles, and land transportation. All members of the IEEE are eligible for membership in the Society. Information about joining the IEEE and the Society are available at www.ieee.org/membership.

IEEE Vehicular Technology Magazine (ISSN 1556-6072) (IVTCU) is published quarterly by The Institute of Electrical and Electronics Engineers, Inc. Headquarters: 3 Park Avenue, 17th Floor, New York, NY 10016-5997, U.S.A. +1 212 419 7900. Responsibility for the contents rests upon the authors and not upon the IEEE, the Society, or its members. The magazine is a membership benefit of the IEEE Vehicular Technology Society, and subscriptions are included in Society fee. Replacement copies for members are available for US\$20 (one copy only). Nonmembers can purchase individual copies for US\$154. Nonmember subscription prices are available on request. Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limits of the U.S. Copyright law for private use of patrons: 1) those post-1977 articles that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01970, U.S.A.; and 2) pre-1978 articles without fee. For other copying, reprint, or republication permission, write to: Copyrights and Permissions Department, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854 U.S.A. Copyright © 2016 by The Institute of Electrical and Electronics Engineers, Inc. All rights reserved. Postmaster: Send address changes to *IEEE Vehicular Technology Magazine*, IEEE, 445 Hoes Lane, Piscataway, NJ 08854 U.S.A. Canadian GST#125634188. PRINTED IN U.S.A.

