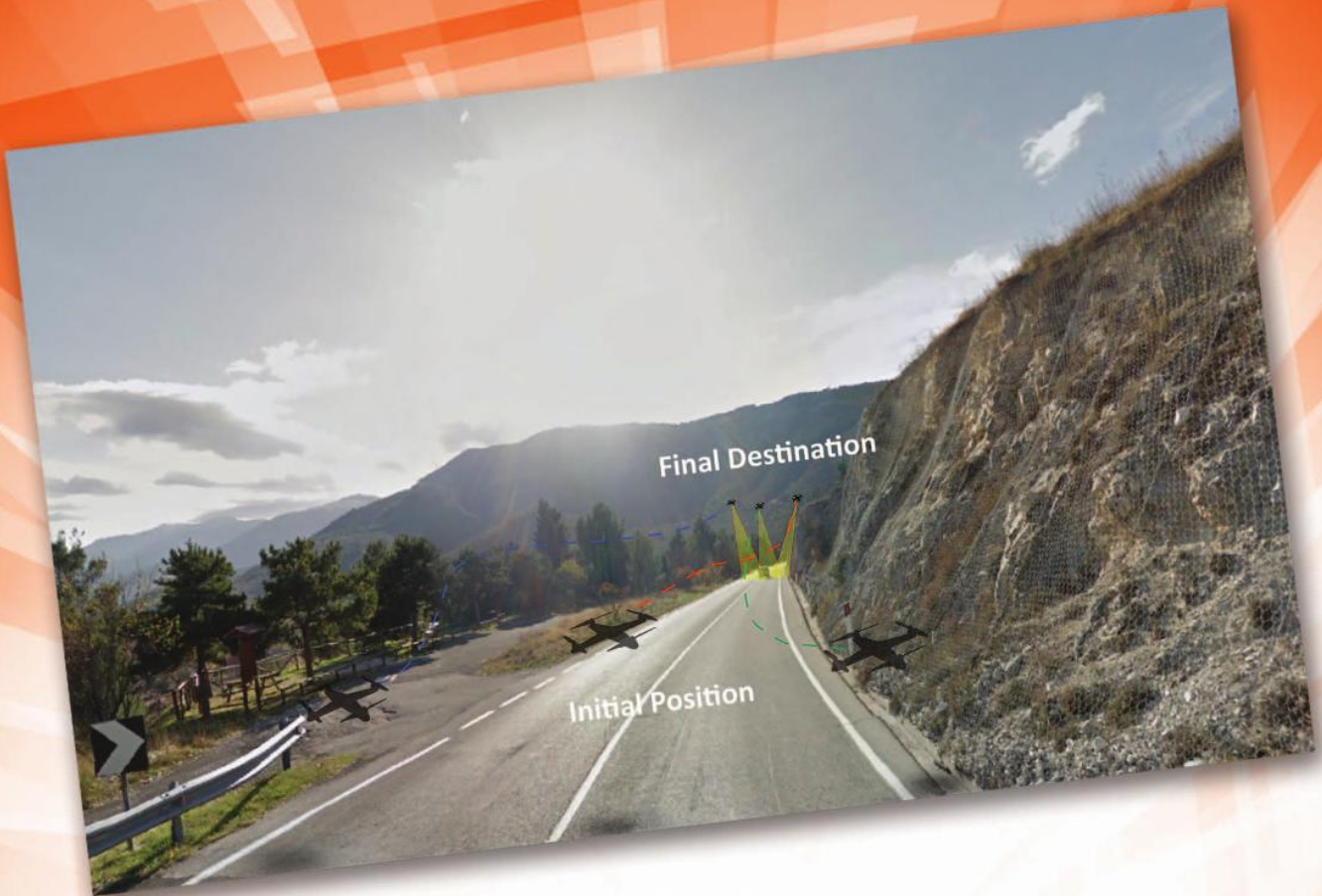


IEEE

control systems

MAGAZINE

AUGUST 2016 VOLUME 36 NUMBER 4



Distributed Control and Estimation of Robotic Vehicle Networks, Part 2

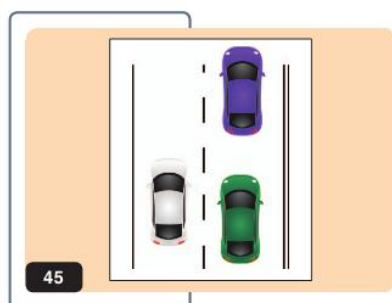
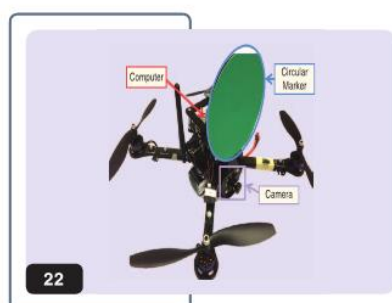


Control Systems Society
Advancing Control Science
and Technology



IEEE

» FEATURES



18 Distributed Control and Estimation of Robotic Vehicle Networks

An overview of Part 2

NISAR R. AHMED, JORGE CORTES, and SONIA MARTÍNEZ

22 A Distributed Optimization Framework for Localization and Formation Control

Applications to vision-based measurements

ROBERTO TRON, JUSTIN THOMAS, GIUSEPPE LOIANNO, KOSTAS DANILIDIS, and VIJAY KUMAR

45 The Role of Information Assumptions in Decentralized Task Allocation

A tutorial

LUKE B. JOHNSON, HAN-LIM CHOI, and JONATHAN P. HOW

59 Safe Coordinated Maneuvering of Teams of Multirotor Unmanned Aerial Vehicles

A cooperative control framework for multivehicle, time-critical missions

VENANZIO CICHELLA, RONALD CHOE, SYED BILAL MEHDI, ENRIC XARGAY, NAIRA HOVAKIMYAN, VLADIMIR DOBROKHODOV, ISAAC KAMINER, ANTÓNIO M. PASCOAL, and A. PEDRO AGUIAR

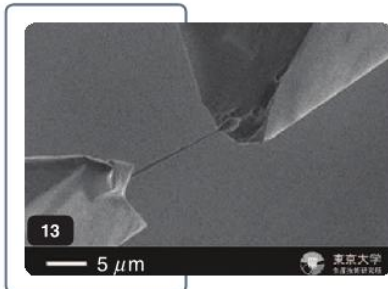
83 Distributed Data Fusion

Neighbors, rumors, and the art of collective knowledge

MARK E. CAMPBELL and NISAR R. AHMED

Cover credit: A cooperative road search example, courtesy of Venanzio Cichella. Background image ©ISTOCKPHOTO.COM/Hluboki

Digital Object Identifier 10.1109/MCS.2016.2558452



- 3 FROM THE EDITOR**
IEEE Control Systems Society Enrollment
- 6 ABOUT THIS ISSUE**
Distributed Control and Estimation of Robotic Vehicle Networks, Part 2
- 9 PRESIDENT'S MESSAGE**
IEEE Control Systems Society and IFAC
- 12 25 YEARS AGO**
- 13 TECHNICAL ACTIVITIES**
Technical Committee on Networks and Communication Systems
Technical Committee on Distributed Parameter Systems
- 110 BOOKSHELF**
Fundamentals of Aerospace Navigation and Guidance
Book Announcements
- 116 CONFERENCE CALENDAR**
- 117 RANDOM INPUTS**
Puzzling Control
- 120 ON THE LIGHTER SIDE**
How Decisions Are Made

**IEEE PERIODICALS
MAGAZINES DEPARTMENT**

445 Hoes Lane, Piscataway,
NJ 08854 USA

Senior Managing Editor
Geraldine Krolin-Taylor

Senior Art Director
Janet Dudar

Associate Art Directors
Gail A. Schnitzer, Mark Morrissey

Production Coordinator
Theresa L. Smith

Advertising Production Manager
Felicia Spagnoli

Production Director
Peter M. Tuohy

*Sr. Manager Advertising & Business
Development*
Mark David

Editorial Director
Dawn M. Melley

*Staff Director
Publishing Operations*
Fran Zappulla

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

MISSION STATEMENT AND SCOPE: As the official means of communication for the IEEE Control Systems Society, *IEEE Control Systems Magazine* publishes interesting, useful, and informative material on all aspects of control system technology for the benefit of control educators, practitioners, and researchers. With this mission statement in mind, *IEEE Control Systems Magazine* encourages submissions, both feature articles and columns, on all aspects of control system technology.

SUBMISSION OF MANUSCRIPTS: A feature article typically provides an in-depth treatment of either an application of control technology, a tutorial on some area of control theory, or an innovation in control education.

IEEE Control Systems Magazine publishes a variety of columns. "Applications of Control" columns are industrially oriented summaries of innovations in control technology. "Focus on Education" typically describes some aspect of education such as novel control experiments. "Lecture Notes" can be theoretical in nature as long as they have clear tutorial value and intent. See recent issues for examples of these and other types of columns. Authors are encouraged to contact the editor-in-chief about the suitability of potential columns.

A detailed Author's Guide, a sample formatted manuscript, and LATEX template can be found at <http://www.ieeecss.org/publications/csm/submissions>. The specifications in this Guide should be followed by all submissions.

All manuscripts should be submitted electronically to the *IEEE Control Systems Magazine* website, <https://css.paperplaza.net/conferences/scripts/start.pl>, with inquiries on appropriateness of content emailed to jhow@mit.edu.

SPECIAL ISSUES: *IEEE Control Systems Magazine* encourages proposals for special issues. Proposers are encouraged to contact the editor-in-chief to discuss potential topics.

BOOKS AND CONFERENCES: Submit information about recently published books to the associate editor for book reviews. Submit information about past and future conferences to the corresponding editor for conferences.

ADVERTISING: *IEEE Control Systems Magazine* accepts advertising for educational products, books, software, conferences, employment, and control-related technology. For information about advertising, contact Mark David, m.david@ieee.org, +1 732 465 6473.

IEEE CONTROL SYSTEMS MAGAZINE—(ISSN 1066-033X) (ISMAD7) is published bimonthly 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 Control Systems Society, and subscriptions are US\$4.00 per member per year (included in Society fee). Replacement copies for members are available for US\$20 (one copy only). Nonmembers can purchase individual copies for US\$96.00. 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. Periodicals postage paid at New York, NY and at additional mailing offices. Postmaster: Send address changes to *IEEE Control Systems Magazine*, IEEE, 445 Hoes Lane, Piscataway, NJ 08854 U.S.A. Canadian GST #125634188

Printed in U.S.A