

» FEATURES

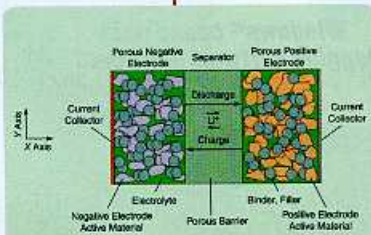


32

32 Adaptive Control and the NASA X-15-3 Flight Revisited

Lessons learned and Lyapunov-stability-based design

ZACHARY T. DYDEK, ANURADHA M. ANNASWAMY, and EUGENE LAVRETSKY



49

49 Algorithms for Advanced Battery-Management Systems

Modeling, estimation, and control challenges for lithium-ion batteries

NALIN A. CHATURVEDI, REINHARDT KLEIN, JAKE CHRISTENSEN, JASIM AHMED, and ALEKSANDAR KOJIC

» DEPARTMENTS



24

6 FROM THE EDITOR

Plagiarize This!

8 ABOUT THIS ISSUE

Battery on Board

12 FEEDBACK

13 PRESIDENT'S MESSAGE

From Hard Copy to Electronic

15 25 YEARS AGO

17 ASK THE EXPERTS

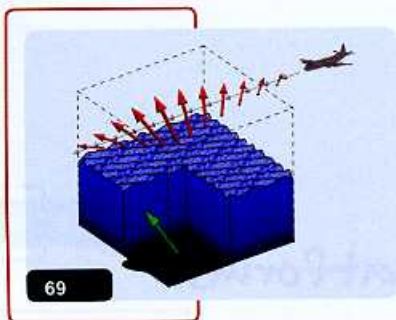
Kalman Quickie

19 APPLICATIONS OF CONTROL

The Tourbillon and How It Works

Cover credit: Creativ Studio Heinemann

Digital Object Identifier 10.1109/MCS.2010.936294



24 PEOPLE IN CONTROL

Yasamin Mostofi
Dale Ulrich
New Fellows

69 HISTORICAL PERSPECTIVES

Applications of Kalman Filtering in
Aerospace 1960 to the Present

79 PERSPECTIVES

A Path Through the Control Community

85 BOOKSHELF

*Distributed Consensus in Multi-vehicle
Cooperative Control: Theory and Applications*
Book Announcements

92 CONFERENCE REPORTS

IEEE ICCA 2009
Paths Ahead in the Science of Information and Decision Systems

98 CDC PREVIEW

CDC 2010 in Atlanta, Georgia

104 MSC PREVIEW

2010 IEEE Multiconference on Systems and Control

107 OBITUARIES

Daniel W. Repperger, Jr.
Tsien Hsue-shen

110 CONFERENCE CALENDAR

112 RANDOM INPUTS

Ode to Backstepping

**IEEE PERIODICALS
MAGAZINES DEPARTMENT**
445 Hoes Lane, Piscataway,
NJ 08854 USA

Senior Managing Editor
Geraldine Krolin-Taylor

Senior Art Director
Janet Dudar

Assistant Art Director
Gail A. Schnitzer

Production Coordinator
Theresa L. Smith

Advertising Production Manager
Felicia Spagnoli

Production Director
Peter M. Tuohy

Business Development Manager
Susan Schneiderman

+1 732 562 3946
Fax: +1 732 981 1855
ss.ieeemedia@ieee.org

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>.

MISSION STATEMENT AND SCOPE: *IEEE Control Systems Magazine* is 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 provides an in-depth treatment of either an application of control technology or an innovation in control education. Maximum length is 30 pages, double spaced, not including figures. Authors wishing to submit longer papers may contact the editor-in-chief.

IEEE Control Systems Magazine publishes a variety of columns. "Lecture Notes" can be theoretical in nature as long as they have clear tutorial value and intent. "Applications of Control" columns are industrially oriented summaries of innovations in control technology. Authors are encouraged to contact the editor-in-chief about the suitability of potential columns.

A detailed Author's Guide can be found at <http://www.ieeeccs.org/PAB/csm/>. The specifications in this Guide must be followed by all submissions.

All manuscripts must be submitted electronically in PDF format to the Editor-in-Chief Dennis S. Bernstein at dsbaero@umich.edu. LATEX is preferred for manuscripts with multiple equations. A LATEX template can be found at <http://www.ieeeccs.org/PAB/csm/>.

SPECIAL SECTIONS: *IEEE Control Systems Magazine* encourages proposals for special sections. 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 Susan Schneiderman, Business Development Manager, IEEE Magazines, 445 Hoes Lane, Piscataway, NJ 08854 USA; +1 732 562 3946; fax: +1 732 981 1855; ss.ieeemedia@ieee.org.

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 \$4.00 per member per year (included in Society fee). Replacement copies for members are available for \$20 (one copy only). Nonmembers can purchase individual copies for \$71.00. 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 © 2010 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