

"Dr. Husain's book, *Electric and Hybrid Vehicles: Design Fundamentals*, is a thorough and insightful introduction to the interdisciplinary topic of traction design for road vehicles. The necessary requirements of energy storage, conversion and processing are presented as the means to providing vehicular performance in a logical progression that students will find readily understandable and practicing engineers will appreciate as a useful reference source. Overall the practical importance of systems engineering and its control are made evident. Salient features are emphasized by worked examples with realistic parameters."

> —Alan Wallace, Department of Electrical Engineering, Oregon State University

"...a balanced blend of traditional and relatively new topics ...The basic aspects of electric and hybrid vehicles are discussed well — from overall concepts to more detailed design — and reinforced through good examples, illustrations, and exercise problems."

—Longya Xu, Professor, Department of Electrical Engineering, The Ohio State University

## A technical, systems-level approach to next-generation vehicles

With advances driven by pressure from governments, environmental activists, and its associated industries, the subject of electric and hybrid vehicles is becoming increasingly important. Trends clearly suggest that engineers must be conversant in the technical details of these vehicles. While there are many books that provide narrative descriptions of electric and hybrid vehicle components, none cover the technical aspects from a mathematically derived, design point of view.

**Electric and Hybrid Vehicles: Design Fundamentals** presents a comprehensive, systems-level perspective of these vehicles that strikes an outstanding balance between technical details, design equations, numerical examples, and case studies. Starting with some historic background, the author describes the system components, the laws of physics governing vehicle motion, the mathematical relationships within and between the components, energy sources, and designing components to meet the complete vehicle specifications.

As this book illustrates, the electric vehicle is an excellent example of electro-mechanical and electro-chemical systems, one that is intriguing, yet technically challenging. The material is ideal for reference, self-study, and short-course work, and the equations presented can be used to develop system-level modeling and simulation tools on suitable platforms, such as MATLAB<sup>®</sup> and Simulink.

# Iqbal Husain

University of Akron, Obio, USA



## **Features**

- Presents a practical, mathematically derived study of design guidelines and the technical aspects of electric and hybrid vehicles
- Includes design examples that help bridge theory and practice
- Contains numerous example problems, exercises, and illustrations in each chapter
- Demonstrates mathematical relationships between system components using design equations

See reverse for contents...

Catalog no. 1466, March 2003, 288 pp. ISBN: 0-8493-1466-6 \$129.95 / £66.99



#### Contents

## INTRODUCTION TO ELECTRIC VEHICLES

EV System Components of EV EV History EV Advantages EV Market

#### **VEHICLE MECHANICS**

Roadway Fundamentals Laws of Motion Vehicle Kinetics Dynamics of Vehicle Motion Propulsion Power Velocity and Acceleration Propulsion System Design

#### **ENERGY SOURCE: BATTERY**

Battery Basics Lead-acid Battery Alternative Batteries Battery Parameters Technical Characteristics Targets and Properties of Batteries Battery Modeling

#### **ALTERNATIVE ENERGY SOURCES**

Fuel Cells Supercapacitors and Ultracapacitors Flywheels

### DC AND AC ELECTRIC MACHINES

Motor and Engine Ratings EV/HEV Motor Requirements DC Machines Three-phase AC Machines Induction Machines Regenerative Braking d-q Modeling

#### **PM AND SR MACHINES**

Permanent Magnet Machines Switched Reluctance Machines

#### POWER ELECTRONICS AND MOTOR DRIVES

Electric Drive Components Power Electronic Switches DC Drives Operating Point Analysis

#### AC AND SR MOTOR DRIVES

AC Drives Vector Control of AC Motors PM Synchronous Motor Drives SR Motor drives

#### **ELECTRIC VEHICLE DRIVETRAIN**

EV Transmission Configuration Transmission Components Ideal Gearbox Steady State Model EV Motor Sizing

### **HYBRID ELECTRIC VEHICLES**

Types of Hybrids Internal Combustion Engines Design of HEV



# Please use this ORDER FORM, CALL, or ORDER ONLINE at WWW.CRCPRESS.COM

#### Please indicate quantities next to the title(s) ordered below:

ELECTRIC and HYBRID VEHICLES: Design Fundamentals .........Catalog no. 1466. ISBN: 0-8493-1466-6 at \$129.95 / £66.99 each.

#### Other titles of interest:

Country

FUEL CELL TECHNOLOGY HANDBOOK ....Catalog no. 0877, ISBN: 0-8493-0877-1 at \$99.95 / £66.99 each.

ELECTRIC DRIVES

......Catalog no. 2521, ISBN: 0-8493-2521-8 at \$94.95 / £62.99 each.

POWER ELECTRONICS HANDBOOK

...Catalog no. 7336, ISBN: 0-8493-7336-0 at \$139.95 / £93.00 each.

Citv	.State/Province	
Address		
Company/Institution		
please print clearly		
Namo		

Ordering Information: Orders must be prepaid or accompanied by a purchase order. Checks should be made payable to CRC Press. Please add the appropriate shipping and handling charge for each book ordered. All prices are subject to change without notice. U.S./Canada: All orders must be paid in U.S. dollars. TAX: As required by law, please add applicable state and local taxes on all merchandise delivered to CA, FL, GA, IL, MA, NJ, NY, and Washington, DC. For Canadian orders, please add GST. We will add tax on all credit card orders. European Orders: All orders must be paid in U.K. £. VAT will be added at the rate applicable. Textbooks: Special prices for course adopted textbooks may be available for certain titles. To review a book for class adoption, contact our Academic Sales Department or submit your textbook evaluation request online at www.crcpress.com/eval.htm Satisfaction Guaranteed; If the book supplied does not meet your expectations, it may be returned to us in a saleable condition within 30 days of receipt for a full refund.

SHIPPING AND HANDLING					
Region	Delivery Time	First Title	Additional Title	For priority	
USA/Canada	3-5 Days	\$5.99	\$1.99	mail services,	
America/Asia/Australia	7-14 Days	\$9.99	\$3.99	please contact	
Europe	3-5 Days	£2.99	£0.99	CRC PRESS	
Middle East/Africa	7-21 Days	£4.99	£2.99	office.	
Visa MasterCard American Express Check Enclosed \$					
Signature	PO#				
Telephone					
If vou would like to receive information from us by e-mail, please provide vour e-mail address below.					

**Corporate Offices** 

E-Mail Address

#### ORDERING LOCATIONS

In North & South America, Asia, and Australasia: CRC PRESS

2000 N.W. Corporate Blvd. Boca Raton, FL 33431-9868, USA Tel: 1-800-272-7737 • Fax: 1-800-374-3401 *From Outside the Continental U.S.* Tel: 1-561-994-0555 • Fax: 1-561-361-6018 e-mail: <u>orders@crcpress.com</u>

#### In Europe, Middle East, and Africa: CRC PRESS / ITPS

Cheriton House, North Way Andover, Hants, SP10 5BE, UK Tel: 44 (0) 1264 342932 Fax: 44 (0) 1264 342788 e-mail: <u>crcpress@itps.co.uk</u> CRC PRESS 2000 N.W. Corporate Blvd. Boca Raton, FL 33431-9868, USA Tel: 1-800-272-7737 • Fax: 1-800-374-3401 *From Outside the Continental U.S.* Tel: 1-561-994-0555 • Fax: 1-561-361-6018 e-mail: orders@crcpress.com

www.crcpress.com

CRC PRESS UK 23-25 Blades Court, Deodar Road London SW15 2NU, UK Tel: 44 (0) 20 8875 4370 Fax: 44 (0) 20 8871 3443 e-mail: enquiries@crcpress.com

3.20.03bh