



# Electric and Hybrid Vehicles: Design Fundamentals

By Iqbal Husain



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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 we must educate the engineers of today and tomorrow 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, and none serve well as a textbook.

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 text illustrates, the electric vehicle is an excellent example of electro-mechanical and electro-chemical systems, one that is technically challenging as well as highly motivating to engineering students. The material presented is designed to be covered comfortably in a one-semester course. Its multidisciplinary nature and systems approach makes Electric and Hybrid Vehicles ideal for teaching electrical, mechanical, and chemical engineers all in one course.



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### Editorial Review

#### Review

...represents a systems-level perspective on electric and hybrid vehicles technical aspects, basic mathematical relationships and fundamental design guidelines. ...The author has chosen to write a book on the basics of EHV, directed mainly to Engineering Students. ...proceeds with remarkable consistence to detail this goal over the 10 chapters of the book...The book is concise and clear, its mathematics are kept to a necessary minimum, but fully representative of the scope and the contents is well balanced in general. ...a new and timely contribution to the field...warmly recommend it to academia...

--Ion Boldea, Journal of Electrical Engineering

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

Through a balanced blend of traditional and relatively new topics, Iqbal Husain's *Electric and Hybrid Vehicles: Design Fundamentals* introduces students to the 'big picture' of EVs and HEVs. This book significantly exposes the students to nearly every aspect of electric and hybrid vehicles without overemphasizing only one topic. 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.

Dr. Husain's well-paced coverage and an easy-to-follow writing style are key to the students' understanding and success. My students will have no problem reading this material regardless of his/her Electrical or Mechanical Engineering background. Being a faculty member in a major university with a strong research EV and HEV program, I feel this book truly provides quite enough materials for my needs and will be a big hit with college students and faculty.

#### About the Author

**Iqbal Husain** is a professor in the Department of Electrical and Computer Engineering at the University of Akron in Ohio. He received his Ph.D. in electrical engineering from Texas A&M University. Dr. Husain is the founder of the Electric and Hybrid Vehicle Program at the University of Akron, which encompasses graduate and undergraduate courses, research on electric drives for electric and hybrid vehicles, and collegiate-level competitions on alternative vehicles. An IEEE Fellow, he is the recipient of the National Science Foundation CAREER award, the IEEE-IAS Outstanding Young Member award, the IEEE Third Millennium Medal, the College of Engineering Outstanding Researcher Award, and the Society of Automotive Engineers Vincent Bendix Automotive Electronics Engineering Award.

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**Charlotte Hawley:**

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**Vera Velez:**

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**Elizabeth Frizzell:**

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