



# ELECTRIC AND HYBRID VEHICLES

Design Fundamentals

THIRD EDITION

Iqbal Husain



CRC Press  
Taylor & Francis Group

# Electric And Hybrid Vehicles Design Fundamentals

**Iqbal Husain**



## **Electric And Hybrid Vehicles Design Fundamentals:**

Electric and Hybrid Vehicles Iqbal Husain, 2021-02-22 A thoroughly revised third edition of this widely praised bestselling textbook presents a comprehensive systems level perspective of electric and hybrid vehicles with emphasis on technical aspects mathematical relationships and basic design guidelines The emerging technologies of electric vehicles require the dedication of current and future engineers so the target audience for the book is the young professionals and students in engineering eager to learn about the area The book is concise and clear its mathematics are kept to a necessary minimum and it contains a well balanced set of contents of the complex technology Engineers of multiple disciplines can either get a broader overview or explore in depth a particular aspect of electric or hybrid vehicles Additions in the third edition include simulation based design analysis of electric and hybrid vehicles and their powertrain components particularly that of traction inverters electric machines and motor drives The technology trends to incorporate wide bandgap power electronics and reduced rare earth permanent magnet electric machines in the powertrain components have been highlighted Charging stations are a critical component for the electric vehicle infrastructure and hence a chapter on vehicle interactions with the power grid has been added Autonomous driving is another emerging technology and a chapter is included describing the autonomous driving system architecture and the hardware and software needs for such systems The platform has been set in this book for system level simulations to develop models using various softwares used in academia and industry such as MATLAB Simulink PLECS PSIM Motor CAD and Altair Flux Examples and simulation results are provided in this edition using these software tools The third edition is a timely revision and contribution to the field of electric vehicles that has reached recently notable markets in a more and more environmentally sensitive world      **Electric and Hybrid Vehicles**

Iqbal Husain, 2011-06-27 Thoroughly updated to encompass the significant technological advances since the publication of the first edition Electric and Hybrid Vehicles Design Fundamentals Second Edition presents the design fundamentals component sizing and systems interactions of alternative vehicles This new edition of a widely praised bestselling textbook maintains the comprehensive systems level perspective of electric and hybrid vehicles while covering the hybrid architectures and components of the vehicle in much greater detail The author emphasizes technical details mathematical relationships and design guidelines throughout the text New to the Second Edition New chapters on sizing and design guidelines for various hybrid architectures control strategies for hybrid vehicles powertrain component cooling systems and in vehicle communication methods New sections on modeling of energy storage components tire road force mechanics compressed air storage DC DC converters emission control systems electromechanical brakes and vehicle fuel economy Reorganization of power electronics electric machines and motor drives sections Enhanced sections on mechanical components that now include more technical descriptions and example problems An emphasis on the integration of mechanical and electrical components taking into account the interdisciplinary nature of automotive engineering As an

advisor to the University of Akron's team in the Challenge X Crossover to Sustainable Mobility Dr Husain knows first hand how to teach students both the fundamentals and cutting edge technologies of the next generation of automobiles This text shows students how electrical and mechanical engineers must work together to complete an alternative vehicle system It empowers them to carry on state of the art research and development in automotive engineering in order to meet today's needs of clean efficient and sustainable vehicles

Electric and Hybrid Vehicles: Design Fundamentals Dr. Viswaprakash Babu, Saidulu Valampatla, Banothu Raju, Dr. Debabrata Das, 2025-02-14 Electric and Hybrid Vehicles Design Fundamentals introduction to the principles design considerations and engineering aspects of electric and hybrid vehicles Key topics such as powertrain architectures energy storage systems motor technologies and control strategies the offers insights into modern advancements and challenges in sustainable transportation It efficiency optimization environmental impact and future trends in vehicle electrification Designed for students researchers and engineers this serves as a foundational resource for understanding the evolving landscape of electric and hybrid vehicle technologies

Solutions Manual for Electric and Hybrid Vehicles Design Fundamentals Husain Iqbal, 2003-08

Electric and Hybrid Vehicles : Design Fundamentals Dr. Viswaprakash Babu, Saidulu Valampatla, Banothu Raju, Dr. Debabrata Das, 2025-04-12 Electric and Hybrid Vehicles Design Fundamentals offers a comprehensive introduction to the principles and engineering of electric and hybrid vehicles It covers powertrains energy storage control systems and design strategies making it ideal for students and professionals seeking foundational knowledge in sustainable automotive technologies and vehicle electrification

**Electric and Hybrid Vehicles** Amir Khajepour, M. Saber Fallah, Avesta Goodarzi, 2014-03-05 An advanced level introductory book covering fundamental aspects design and dynamics of electric and hybrid electric vehicles There is significant demand for an understanding of the fundamentals technologies and design of electric and hybrid electric vehicles and their components from researchers engineers and graduate students Although there is a good body of work in the literature there is still a great need for electric and hybrid vehicle teaching materials Electric and Hybrid Vehicles Technologies Modeling and Control A Mechatronic Approach is based on the authors current research in vehicle systems and will include chapters on vehicle propulsion systems the fundamentals of vehicle dynamics EV and HEV technologies chassis systems steering control systems and state parameter and force estimations The book is highly illustrated and examples will be given throughout the book based on real applications and challenges in the automotive industry Designed to help a new generation of engineers needing to master the principles of and further advances in hybrid vehicle technology Includes examples of real applications and challenges in the automotive industry with problems and solutions Takes a mechatronics approach to the study of electric and hybrid electric vehicles appealing to mechanical and electrical engineering interests Responds to the increase in demand of universities offering courses in newer electric vehicle technologies

**Modern Electric, Hybrid Electric, and Fuel Cell Vehicles** Mehrdad Ehsani, Yimin Gao, Ali Emadi, 2017-12-19 Air pollution global warming and the steady decrease in petroleum

resources continue to stimulate interest in the development of safe clean and highly efficient transportation Building on the foundation of the bestselling first edition Modern Electric Hybrid Electric and Fuel Cell Vehicles Fundamentals Theory and Design Second Edition updates and expands its detailed coverage of the vehicle technologies that offer the most promising solutions to these issues affecting the automotive industry Proven as a useful in depth resource and comprehensive reference for modern automotive systems engineers students and researchers this book speaks from the perspective of the overall drive train system and not just its individual components New to the second edition A case study appendix that breaks down the Toyota Prius hybrid system Corrections and updates of the material in the first edition Three new chapters on drive train design methodology and control principles A completely rewritten chapter on Fundamentals of Regenerative Braking Employing sufficient mathematical rigor the authors comprehensively cover vehicle performance characteristics EV and HEV configurations control strategies modeling and simulations for modern vehicles They also cover topics including Drive train architecture analysis and design methodologies Internal Combustion Engine ICE based drive trains Electric propulsion systems Energy storage systems Regenerative braking Fuel cell applications in vehicles Hybrid electric drive train design The first edition of this book gave practicing engineers and students a systematic reference to fully understand the essentials of this new technology This edition introduces newer topics and offers deeper treatments than those included in the first Revised many times over many years it will greatly aid engineers students researchers and other professionals who are working in automotive related industries as well as those in government and academia

**Inorganic Nanomaterials for Supercapacitor Design** Dr. Inamuddin,Rajender Boddula,Mohd Imran Ahamed,Abdullah Mohamed Asiri,2019-12-20 Among electrode materials inorganic materials have received vast consideration owing to their redox chemistry chemical stability high electrochemical performance and high power applications These exceptional properties enable inorganic based materials to find application in high performance energy conversion and storage The current advances in nanotechnology have uncovered novel inorganic materials by various strategies and their different morphological features may serve as a rule for future supercapacitor electrode design for efficient supercapacitor performance Inorganic Nanomaterials for Supercapacitor Design depicts the latest advances in inorganic nanomaterials for supercapacitor energy storage devices Key Features Provides an overview on the supercapacitor application of inorganic based materials Describes the fundamental aspects key factors advantages and challenges of inorganic supercapacitors Presents up to date coverage of the large rapidly growing and complex literature on inorganic supercapacitors Surveys current applications in supercapacitor energy storage Explores the new aspects of inorganic materials and next generation supercapacitor systems

**Electric Vehicles for Smart Cities** Evanthia A. Nanaki,2020-10-07 Electric Vehicles for Smart Cities Trends Challenges and Opportunities uniquely examines different approaches to electric vehicle deployment in the context of smart cities It provides a holistic picture of electromobility within urban areas offering an integrated approach to city transportation systems by considering the energy

systems latest vehicle technologies and transport infrastructure Electric Vehicles for Smart Cities addresses the interaction between grid infrastructure vehicles costs and benefits and operational reliability within an integrated framework The book examines the role electric vehicles play in the social and political aspects of climate change mitigation as well as a renewable energy based economy It explains how electric vehicles and their system requirements work including recharging techniques and infrastructures and discusses alternative market deployment approaches Includes case studies from cities around the world including Amsterdam London Oslo Barcelona Los Angeles New York Silicon Valley Los Angeles Beijing Shanghai Tianjin Tokyo and Goto Islands Traces the developments innovations advantages and disadvantages in the electric car industry Provides learning aids such as discussion questions and text boxes

#### **Vehicle Power Management** Xi

Zhang,Chris Mi,2011-08-12 Vehicle Power Management addresses the challenge of improving vehicle fuel economy and reducing emissions without sacrificing vehicle performance reliability and durability It opens with the definition objectives and current research issues of vehicle power management before moving on to a detailed introduction to the modeling of vehicle devices and components involved in the vehicle power management system which has been proven to be the most cost effective and efficient method for initial phase vehicle research and design Specific vehicle power management algorithms and strategies including the analytical approach optimal control intelligent system approaches and wavelet technology are derived and analyzed for realistic applications Vehicle Power Management also gives a detailed description of several key technologies in the design phases of hybrid electric vehicles containing battery management systems component optimization hardware in the loop and software in the loop Vehicle Power Management provides graduate and upper level undergraduate students engineers and researchers in both academia and the automotive industry with a clear understanding of the concepts methodologies and prospects of vehicle power management

#### **Transition to Sustainable Energy**

**Technologies** Carlo Villante,Sonia Dell'Aversano,Stefano Ranieri,2025-06-27 This book explains the challenges related to global energy transition focusing on decarbonization renewable technologies and sustainable mobility It offers a comprehensive exploration of integrated socio economic environmental and technological perspectives and provides actionable solutions and practical pathways for transitioning to sustainable energy systems Designed to be used in short academic courses this textbook is an excellent foundational text for upper level undergraduate and graduate students in engineering and environmental sciences taking specialized courses in energy systems renewable technologies climate change mitigation and environmental impacts It is also a great resource for professionals and policy makers involved in energy projects Features Offers an interdisciplinary approach to energy transitions combining theoretical frameworks with practical applications Explores the full spectrum of energy systems comparing conventional to renewable sources energy vectors and energy storage technologies Incorporates real world data from leading institutions and integrates key historical milestones like the Paris Agreement with forward looking trends Highlights cutting edge innovations including solar and wind energy

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**Hybrid Electric Vehicles** Chris Mi, M. Abul Masrur, David Wenzhong Gao, 2011-05-23 Modern Hybrid Electric Vehicles provides vital guidance to help a new generation of engineers master the principles of and further advance hybrid vehicle technology The authors address purely electric hybrid electric plug in hybrid electric hybrid hydraulic fuel cell and off road hybrid vehicle systems They focus on the power and propulsion systems for these vehicles including issues related to power and energy management They concentrate on material that is not readily available in other hybrid electric vehicle HEV books such as design examples for hybrid vehicles and cover new developments in the field including electronic CVT plug in hybrid and new power converters and controls Covers hybrid vs pure electric HEV system architecture including plug in and hydraulic off road and other industrial utility vehicles non ground vehicle applications like ships locomotives aircrafts system reliability EMC storage technologies vehicular power and energy management diagnostics and prognostics and electromechanical vibration issues Contains core fundamentals and principles of modern hybrid vehicles at component level and system level Provides graduate students and field engineers with a text suitable for classroom teaching or self study

[Lightweight Electric/Hybrid Vehicle Design](#) John Fenton, Ron Hodkinson, 2001-07-04 Lightweight Electric Hybrid Vehicle Design covers the particular automotive design approach required for hybrid electrical drive vehicles There is currently huge investment world wide in electric vehicle propulsion driven by concern for pollution control and depleting oil resources The radically different design demands of these new vehicles requires a completely new approach that is covered comprehensively in this book The book explores the rather dramatic departures in structural configuration necessary for purpose designed electric vehicle including weight removal in the mechanical systems It also provides a comprehensive review of the design process in the electric hybrid drive and energy storage systems Ideal for automotive engineering students and professionals Lightweight Electric Hybrid Vehicle Design provides a complete introduction to this important new sector of the industry Comprehensive coverage of all design aspects of electric hybrid cars in a single volume Packed with case studies and applications In depth treatment written in a text book style rather than a theoretical specialist text style

**The 30th SIAR International Congress of Automotive and**

**Transport Engineering** Ilie Dumitru, Dinu Covaciu, Laurențiu Racila, Adrian Rosca, 2019-10-15 This proceedings book includes papers that cover the latest developments in automotive vehicles and environment advanced transport systems and road traffic heavy and special vehicles new materials manufacturing technologies and logistics and advanced engineering methods Authors of the papers selected for this book are experts from research industry and universities coming from different countries The overall objectives of the presentations are to respond to the major challenges faced by the automotive industry and to propose potential solutions to problems related to automotive technology transportation and environment and road safety The congress is organized by SIAR Society of Automotive Engineers from Romania in cooperation with SAE International The purpose is to gather members from academia industry and government and present their possibilities for investigations and research in order to establish new future collaborations in the automotive engineering and transport domain This proceedings book is just a part of the outcomes of the congress The results presented in this proceedings book benefit researchers from academia and research institutes industry specialists Ph D students and students in Automotive and Transport Engineering programs

**Intelligent Computing Systems and Applications** Sivaji Bandyopadhyay, Valentina Emilia Balas, Saroj Kumar Biswas, Anish Kumar Saha, Dalton Meitei Thounaojam, 2024-09-19 The book includes peer reviewed papers presented at the 2nd International Conference on Intelligent Computing Systems and Applications ICICSA 2023 The book discusses the most recent advances in artificial intelligence machine learning data science natural language processing computer vision image processing embedded systems robotics IoT computer networking and communications optimization security and cryptography among other topics It also discusses several application areas and modeling methodologies in many fields This book will be useful for researchers and academics working in relevant fields

**Advanced Battery Management System for Electric Vehicles** Shichun Yang, Xinhua Liu, Shen Li, Cheng Zhang, 2022-09-19 The battery management system BMS optimizes the efficiency of batteries under allowable conditions and prevents serious failure modes This book focuses on critical BMS techniques such as battery modeling estimation methods for state of charge state of power and state of health battery charging strategies active and passive balancing methods and thermal management strategies during the entire lifecycle It also introduces functional safety and security related design for BMS and discusses potential future technologies like digital twin technology

**Neural Information Processing** Derong Liu, Shengli Xie, Yuanqing Li, Dongbin Zhao, El-Sayed M. El-Alfy, 2017-11-07 The six volume set LNCS 10634 LNCS 10635 LNCS 10636 LNCS 10637 LNCS 10638 and LNCS 10639 constitutes the proceedings of the 24rd International Conference on Neural Information Processing ICONIP 2017 held in Guangzhou China in November 2017 The 563 full papers presented were carefully reviewed and selected from 856 submissions The 6 volumes are organized in topical sections on Machine Learning Reinforcement Learning Big Data Analysis Deep Learning Brain Computer Interface Computational Finance Computer Vision Neurodynamics Sensory Perception and Decision Making Computational Intelligence Neural Data Analysis Biomedical



Engineering Emotion and Bayesian Networks Data Mining Time Series Analysis Social Networks Bioinformatics Information Security and Social Cognition Robotics and Control Pattern Recognition Neuromorphic Hardware and Speech Processing

**Power Electronics for Electric Vehicles and Energy Storage** Dharavath Kishan,Ramani Kannan,B Dastagiri Reddy,Prajof Prabhakaran,2023-05-16 This text will help readers to gain knowledge about designing power electronic converters and their control for electric vehicles It discusses the ways in which power from electric vehicle batteries is transferred to an electric motor the technology used for charging electric vehicle batteries and energy storage The text covers case studies and real life examples related to electric vehicles The book Discusses the latest advances and developments in the field of electric vehicles Examines the challenges associated with the integration of renewable energy sources with electric vehicles Highlights basic understanding of the charging infrastructure for electric vehicles Covers concepts including the reliability of power converters in electric vehicles and battery management systems This book discusses the challenges emerging technologies and recent development of power electronics for electric vehicles It will serve as an ideal reference text for graduate students and academic researchers in the fields of electrical engineering electronics and communication engineering environmental engineering automotive engineering and computer science

**Power Electronics and Electric Drives for Traction Applications** Gonzalo Abad,2016-09-13 Power Electronics and Electric Drives for Traction Applications offers a practical approach to understanding power electronics applications in transportation systems ranging from railways to electric vehicles and ships It is an application oriented book for the design and development of traction systems accompanied by a description of the core technology The first four introductory chapters describe the common knowledge and background required to understand the preceding chapters After that each application specific chapter highlights the significant manufacturers involved provides a historical account of the technological evolution experienced distinguishes the physics and mechanics and where possible analyses a real life example and provides the necessary models and simulation tools block diagrams and simulation based validations Key features Surveys power electronics state of the art in all aspects of traction applications Presents vital design and development knowledge that is extremely important for the professional community in an original simple clear and complete manner Offers design guidelines for power electronics traction systems in high speed rail ships electric hybrid vehicles elevators and more applications Application specific chapters co authored by traction industry expert Learning supplemented by tutorial sections case studies and MATLAB Simulink based simulations with data from practical systems A valuable reference for application engineers in traction industry responsible for design and development of products as well as traction industry researchers developers and graduate students on power electronics and motor drives needing a reference to the application examples

The book delves into Electric And Hybrid Vehicles Design Fundamentals. Electric And Hybrid Vehicles Design Fundamentals is a vital topic that needs to be grasped by everyone, from students and scholars to the general public. The book will furnish comprehensive and in-depth insights into Electric And Hybrid Vehicles Design Fundamentals, encompassing both the fundamentals and more intricate discussions.

1. This book is structured into several chapters, namely:
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    - Chapter 4: Electric And Hybrid Vehicles Design Fundamentals in Specific Contexts
    - Chapter 5: Conclusion
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  5. In chapter 4, the author will scrutinize the relevance of Electric And Hybrid Vehicles Design Fundamentals in specific contexts. The fourth chapter will explore how Electric And Hybrid Vehicles Design Fundamentals is applied in specialized fields, such as education, business, and technology.
  6. In chapter 5, the author will draw a conclusion about Electric And Hybrid Vehicles Design Fundamentals. This chapter will summarize the key points that have been discussed throughout the book.
- The book is crafted in an easy-to-understand language and is complemented by engaging illustrations. It is highly recommended for anyone seeking to gain a comprehensive understanding of Electric And Hybrid Vehicles Design Fundamentals.

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