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Electric Vehicles and Sustainable Transportation



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The information presented in this book is intended for academic study, teaching, research, and professional reference in electric vehicle technology, automotive engineering, energy systems, and sustainable transportation. The scientific principles, engineering concepts, battery technologies, electric propulsion systems, charging infrastructure, vehicle dynamics, energy management strategies, and sustainable mobility applications are provided for educational and illustrative purposes. Although reasonable care has been taken to ensure accuracy, the Publisher does not guarantee the completeness, reliability, or suitability of the information for specific research, engineering, industrial, or commercial applications. Readers are advised to consult current scientific literature, applicable engineering standards, government policies, safety regulations, and relevant legal requirements before applying the concepts and technologies described.

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About the Author



Dr. Prangya Parimita Pradhan is an Assistant Professor in the Department of Electrical and Electronics Engineering at the School of Engineering and Technology, Centurion University of Technology and Management (CUTM), Odisha, India. She also serves as the Associate Dean of the School of Computational and Data Sciences (SoCDS), where she plays a key role in academic leadership, curriculum design, interdisciplinary research, and institutional development.

She obtained her M.Tech. and Ph.D. degrees in Electrical Engineering from the National Institute of Technology (NIT), Rourkela, India. Her research interests encompass renewable energy systems, smart grids, power electronics, advanced control techniques, hybrid energy storage systems, Industrial Internet of Things (IIoT), and power quality enhancement. Her current research is primarily focused on the integration of these technologies with electric vehicle (EV) systems, including renewable energy-powered EV charging infrastructure, multiport power converter design, battery–super capacitor hybrid energy storage systems, intelligent energy management strategies, bidirectional power flow control, and grid-connected EV charging technologies. Her research aims to develop efficient, intelligent, and sustainable energy solutions that support the transition toward next-generation electric mobility and resilient power systems.

Dr. Pradhan has made significant scholarly contributions through the publication of numerous research papers in high-impact international journals and reputed conference proceedings. She has also authored book chapters, secured patents, and actively contributes to advancing research in the fields of renewable energy, power electronics, electric transportation, and intelligent energy systems. She has successfully organized and coordinated several Faculty Development Programmes (FDPs), workshops, seminars, and technical conferences, while actively engaging in curriculum development, postgraduate research supervision, academic administration, and collaborative research initiatives.

As an educator and researcher, Dr. Pradhan is committed to promoting excellence in engineering education and fostering innovative research that bridges academia and industry. Her work is directed toward developing sustainable, energy-efficient, and intelligent technologies that accelerate the integration of renewable energy resources with electric transportation and contribute to the realization of future smart and sustainable power systems.

Preface

The transportation sector is undergoing a remarkable transformation with the increasing adoption of electric vehicles and sustainable mobility technologies. Growing concerns about environmental pollution, climate change, energy security, and dependence on fossil fuels have accelerated the development of cleaner and more energy-efficient transportation systems. Advances in battery technologies, electric propulsion, power electronics, charging infrastructure, and renewable energy integration are playing a significant role in this transition.

The book ***Electric Vehicles and Sustainable Transportation*** has been written to provide a comprehensive understanding of the fundamental principles, engineering technologies, and practical applications of electric mobility. It aims to bridge the gap between theoretical concepts and real-world applications while presenting technical information in a clear, systematic, and accessible manner.

The book comprises sixteen chapters, beginning with an introduction to electric vehicles, their architecture, and powertrain systems. Subsequent chapters discuss electric machines, power electronics, battery technologies, energy storage systems, battery management, thermal management, and charging infrastructure. The book also covers renewable energy integration, hybrid and fuel-cell electric vehicles, vehicle design and simulation, sustainable transportation planning, environmental assessment, policies, standards, economics, and emerging trends in electric mobility. A dedicated Do-It-Yourself Projects section has been included to promote practical understanding, technical skills, and application-oriented learning.

This book is primarily intended for undergraduate and postgraduate students of electrical, mechanical, automobile, energy, and transportation engineering. It will also serve as a useful reference for researchers, academicians, practicing engineers, industry professionals, and individuals interested in sustainable transportation technologies. Emphasis has been placed on conceptual clarity, scientific accuracy, engineering relevance, and practical applicability.

I hope this book will contribute to a better understanding of electric vehicle technologies and encourage innovative approaches towards energy-efficient and environmentally sustainable transportation. Suggestions and constructive feedback from readers will be sincerely appreciated and considered for future editions.

Dr. Prangya Parimita Pradhan

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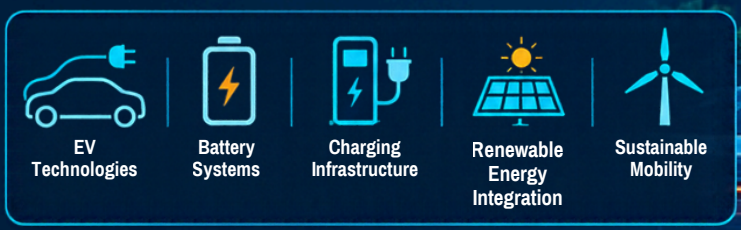
Electric Vehicles and Sustainable Transportation

ABOUT THE BOOK

Electric Vehicles and Sustainable Transportation: Concepts and Applications provides a comprehensive introduction to the technologies, systems and strategies shaping the future of mobility. The book examines electric vehicle architectures, electric machines and power electronics, battery technologies and management systems, charging infrastructure, renewable energy integration, vehicle-to-grid concepts, energy management strategies and sustainable transportation solutions. Combining foundational concepts with practical applications, it is designed for undergraduate and postgraduate students, researchers, educators and professionals in engineering and allied disciplines.



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