

Power Systems

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Advanced Electrical Drives

Analysis, Modeling, Control

Second Edition



 Springer

Advanced Electrical Drives Analysis Modeling Control Power Systems

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Advanced Electrical Drives Analysis Modeling Control Power Systems:

Advanced Electrical Drives Rik De Doncker, Duco W.J. Pulle, André Veltman, 2010-11-30 Electrical drives convert in a controlled manner electrical energy into mechanical energy. Electrical drives comprise an electrical machine i.e. an electro-mechanical energy converter, a power electronic converter i.e. an electrical to electrical converter and a controller communication unit. Today electrical drives are used as propulsion systems in high speed trains, elevators, escalators, electric ships, electric forklift trucks and electric vehicles. Advanced control algorithms, mostly digitally implemented, allow torque control over a high bandwidth. Hence precise motion control can be achieved. Examples are drives in robots, pick and place machines, factory automation hardware etc. Most drives can operate in motoring and generating mode. Wind turbines use electrical drives to convert wind energy into electrical energy. More and more variable speed drives are used to save energy, for example in air conditioning units, compressors, blowers, pumps and home appliances. Key to ensure stable operation of a drive in the aforementioned applications are torque control algorithms. In Advanced Electrical Drives a unique approach is followed to derive model based torque controllers for all types of Lorentz force machines i.e. DC synchronous and induction machines. The rotating transformer model forms the basis for this generalized modeling approach that ultimately leads to the development of universal field oriented control algorithms. In case of switched reluctance machines torque observers are proposed to implement direct torque algorithms. From a didactic viewpoint tutorials are included at the end of each chapter. The reader is encouraged to execute these tutorials to familiarize him or herself with all aspects of drive technology. Hence Advanced Electrical Drives encourages learning by doing. Furthermore the experienced drive specialist may find the simulation tools useful to design high performance controllers for all sorts of electrical drives. Advanced Electrical Drives Rik W. De Doncker, Duco W.J. Pulle, André Veltman, 2020-08-21 This book provides a unique approach to derive model based torque controllers for all types of Lorentz force machines i.e. DC synchronous and induction machines. The rotating transformer model forms the basis for the generalized modeling approach of rotating field machines which leads to the development of universal field oriented control algorithms. Contrary to this direct torque control algorithms using observer based methods are developed for switched reluctance machines. Tutorials are included at the end of each chapter and the reader is encouraged to execute these tutorials in order to gain familiarity with the dynamic behavior of drive systems. This updated edition uses PLECS simulation and vector processing tools that were specifically adopted for the purpose of these hands on tutorials. Hence Advanced Electrical Drives encourages learning by doing and the experienced drive specialist may find the simulation tools useful to design high performance torque controllers. Although it is a powerful reference in its own right when used in conjunction with the companion texts Fundamentals of Electrical Drives and Applied Control of Electrical Drives this book provides a uniquely comprehensive reference set that takes readers all the way from understanding the basics of how electrical drives work to deep familiarity with advanced features and models to a mastery of applying the

concepts to actual hardware in practice Teaches readers to perform insightful analysis of AC electrical machines and drives Introduces new modeling methods and modern control techniques for switched reluctance drives Updated to use PLECS simulation tools for modeling electrical drives including new and more experimental results Numerous tutorials at end of each chapter to learn by doing step by step Includes extra material featuring build and play lab modules for lectures and self study

Switched Reluctance Motor Ahmed Tahour, Abdel Ghani Aissaoui, 2017-06-21 In the last years the switched reluctance machines SRMs have been the subject of significant developments SRMs are gaining much interest because of their simplicity in structures high output power high starting torque wide speed range rugged and robust construction reliability and low manufacturing costs which make these machines viable for many applications SRMs include machines of different structures whose common property is the significant variation in the shape of the air gap during rotation The use of advanced control technologies makes possible the integration of the mechanical and electrical conversion systems in their optimal mode of operation Different strategies of control can be applied to SRMs depending on their mode of functioning and the purpose of their applications The goal of this book is to present recent works on concept control and applications in switched reluctance machines

Hybrid Electric Power Train Engineering and Technology: Modeling, Control, and Simulation Szumanowski, Antoni, 2013-05-31 Hybridization is an increasingly popular paradigm in the auto industry but one that is not fully understood by car manufacturers In general hybrid electric vehicles HEV are designed without regard to the mechanics of the power train which is developed similarly to its counterparts in internal combustion engines Hybrid Electric Power Train Engineering and Technology Modeling Control and Simulation provides readers with an academic investigation into HEV power train design using mathematical modeling and simulation of various hybrid electric motors and control systems This book explores the construction of the most energy efficient power trains which is of importance to designers manufacturers and students of mechanical engineering This book is part of the Research Essentials collection

Aerospace Actuators 2 Jean-Charles Maré, 2017-04-24 This book is the second in a series of volumes which cover the topic of aerospace actuators following a systems based approach This second volume brings an original functional and architectural vision to more electric aerospace actuators The aspects of signal Signal by Wire and power Power by Wire are treated from the point of view of needs their evolution throughout history and operational solutions that are in service or in development This volume is based on an extensive bibliography numerous supporting examples and orders of magnitude which refer to flight controls and landing gear for various aircraft fixed or rotorwing launchers in commercial private and military applications The topics covered in this set of books constitute a significant source of information for individuals and engineers from a variety of disciplines seeking to learn more about aerospace actuation systems and components

Advanced Electric Drive Vehicles Ali Emadi, 2014-10-02 Electrification is an evolving paradigm shift in the transportation industry toward more efficient higher performance safer smarter and more reliable vehicles There is in fact a clear trend to move from internal

combustion engines ICEs to more integrated electrified powertrains Providing a detailed overview of this growing area Advanced Electric Drive Vehicles begins with an introduction to the automotive industry an explanation of the need for electrification and a presentation of the fundamentals of conventional vehicles and ICEs It then proceeds to address the major components of electrified vehicles i e power electronic converters electric machines electric motor controllers and energy storage systems This comprehensive work Covers more electric vehicles MEVs hybrid electric vehicles HEVs plug in hybrid electric vehicles PHEVs range extended electric vehicles REEVs and all electric vehicles EVs including battery electric vehicles BEVs and fuel cell vehicles FCVs Describes the electrification technologies applied to nonpropulsion loads such as power steering and air conditioning systems Discusses hybrid battery ultra capacitor energy storage systems as well as 48 V electrification and belt driven starter generator systems Considers vehicle to grid V2G interface and electrical infrastructure issues energy management and optimization in advanced electric drive vehicles Contains numerous illustrations practical examples case studies and challenging questions and problems throughout to ensure a solid understanding of key concepts and applications Advanced Electric Drive Vehicles makes an ideal textbook for senior level undergraduate or graduate engineering courses and a user friendly reference for researchers engineers managers and other professionals interested in transportation electrification **Control of Permanent Magnet Synchronous Motors** Sadegh Vaez-Zadeh,2018

Permanent magnet synchronous PMS motors stand at the forefront of electric motor development due to their energy saving capabilities and performance potential This book is a timely advancement along that path as the first comprehensive self contained and thoroughly up to date book devoted solely to the control of PMS motors *Advanced Technologies in Electric Vehicles* Vijayakumar Gali,Luciane Neves Canha,Mariana Resener,Bibiana Ferraz,Madisa V.G. Varaprasad,2024-02-26

Advanced Technologies in Electric Vehicles Challenges and Future Research Developments discusses fundamental and advanced concepts challenges and future perspectives surrounding EVs Sections cover advances and long term challenges such as battery life span efficiency and power management systems In addition the book covers all aspects of the EV field including vehicle performance configuration control strategy design methodology modeling and simulation for different conventional and modern vehicles based on mathematical equations By tackling the fundamentals theory and design of conventional electric vehicles EVs hybrid electric vehicles HEVs and fuel cell vehicles FCVs this book presents a comprehensive reference Investment in hybrid and electric vehicle EV technology research has been increasing steadily in recent years both from governments and within companies The role of the combustion engine in causing climate change has put the automobile industry on a path of rapid evolution towards electric vehicles bringing experts with a range of backgrounds into the field Provides the latest advances in battery management systems to address power quality issues Explains step by step methodologies for the testing of EV battery systems Explores the technological options for charging systems and charging infrastructure **Advanced Control Systems for Electric Drives** Adel Merabet,2020-12-07 This

book provides extensive information about advanced control techniques in electric drives Multiple control and estimation methods are studied for position and speed tracking in different drives Artificial intelligence tools such as fuzzy logic and neural networks are used for specific applications using electric drives *Development of Adaptive Speed Observers for Induction Machine System Stabilization* Ahmed A. Zaki Diab,Abo-Hashima M. Al-Sayed,Hossam Hefnawy Abbas Mohammed,Yehia Sayed Mohammed,2020-01-03 This book describes the development of an adaptive state observer using a mathematical model to achieve high performance for sensorless induction motor drives This involves first deriving an expression for a modified gain rotor flux observer with a parameter adaptive scheme to estimate the motor speed accurately and improve the stability and performance of sensorless vector controlled induction motor drives This scheme is then applied to the controls of a photovoltaic motor water pumping system which results in improved dynamic performance under different operating conditions The book also presents a robust speed controller design for a sensorless vector controlled induction motor drive system based on H theory which overcomes the problems of the classical controller

The book delves into Advanced Electrical Drives Analysis Modeling Control Power Systems. Advanced Electrical Drives Analysis Modeling Control Power Systems is a crucial topic that must be grasped by everyone, ranging from students and scholars to the general public. This book will furnish comprehensive and in-depth insights into Advanced Electrical Drives Analysis Modeling Control Power Systems, encompassing both the fundamentals and more intricate discussions.

1. The book is structured into several chapters, namely:
 - Chapter 1: Introduction to Advanced Electrical Drives Analysis Modeling Control Power Systems
 - Chapter 2: Essential Elements of Advanced Electrical Drives Analysis Modeling Control Power Systems
 - Chapter 3: Advanced Electrical Drives Analysis Modeling Control Power Systems in Everyday Life
 - Chapter 4: Advanced Electrical Drives Analysis Modeling Control Power Systems in Specific Contexts
 - Chapter 5: Conclusion
2. In chapter 1, the author will provide an overview of Advanced Electrical Drives Analysis Modeling Control Power Systems. The first chapter will explore what Advanced Electrical Drives Analysis Modeling Control Power Systems is, why Advanced Electrical Drives Analysis Modeling Control Power Systems is vital, and how to effectively learn about Advanced Electrical Drives Analysis Modeling Control Power Systems.
3. In chapter 2, the author will delve into the foundational concepts of Advanced Electrical Drives Analysis Modeling Control Power Systems. This chapter will elucidate the essential principles that must be understood to grasp Advanced Electrical Drives Analysis Modeling Control Power Systems in its entirety.
4. In chapter 3, this book will examine the practical applications of Advanced Electrical Drives Analysis Modeling Control Power Systems in daily life. This chapter will showcase real-world examples of how Advanced Electrical Drives Analysis Modeling Control Power Systems can be effectively utilized in everyday scenarios.
5. In chapter 4, this book will scrutinize the relevance of Advanced Electrical Drives Analysis Modeling Control Power Systems in specific contexts. This chapter will explore how Advanced Electrical Drives Analysis Modeling Control Power Systems is applied in specialized fields, such as education, business, and technology.
6. In chapter 5, this book will draw a conclusion about Advanced Electrical Drives Analysis Modeling Control Power Systems. The final chapter will summarize the key points that have been discussed throughout the book.

This book is crafted in an easy-to-understand language and is complemented by engaging illustrations. This book is highly recommended for anyone seeking to gain a comprehensive understanding of Advanced Electrical Drives Analysis Modeling Control Power Systems.

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