Analysis And Design Of A High Power Digitally Controlled Spacecraft Power System

#spacecraft power system #digital power control #high power design #satellite power management #aerospace electronics

This document delves into the rigorous analysis and innovative design principles behind a high-power, digitally controlled spacecraft power system. It covers critical aspects of power conversion, distribution, and intelligent management crucial for reliable operation in demanding space environments, ensuring optimal performance for satellite missions.

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Large Space Structures & Systems in the Space Station Era

This book provides an introduction to the main design principles, methods, procedures, and development trends in spacecraft power systems. It is divided into nine chapters, the first of which covers the classification and main components of primary power system design and power distribution system design. In turn, Chapters 2 to 4 focus on the spacecraft power system design experience and review the latest typical design cases concerning spacecraft power systems in China. More specifically, these chapters also introduce readers to the topological structure and key technologies used in spacecraft power systems. Chapters 5 to 7 address power system reliability and safety design, risk analysis and control, and in-orbit management in China's spacecraft engineering projects. The book's closing chapters provide essential information on new power systems and technologies, such as space nuclear power, micro- and nano-satellite power systems, and space energy interconnection systems. An outlook on future development trends rounds out the coverage.

Scientific and Technical Aerospace Reports

This second edition of Spacecraft Power Systems is a comprehensive coverage of the fundamentals, design trades, components, controls, and operations of spacecraft power systems based on the real-world design and operations of spacecraft that have successfully flown for decades. It also includes emerging high-voltage, high-power systems for in-space propulsion for interplanetary travel. With new and updated chapters, sections, and discussions, the second edition covers up-to-date high-voltage, MW-scale electric propulsion, updated PV and battery systems, spacecraft power components, power electronics, and their architectures and operations. This book also presents the latest in spacecraft design processes and trades, controls, operations, and protection. This book is intended for senior undergraduate and graduate students in mechanical, aerospace, and electrical engineering taking courses in Space Systems, Space Engineering, and Spacecraft Power Systems, as well as for practicing aerospace and power engineers and managers who are designing, developing, and operating spacecraft power systems.

Spacecraft Power System Technologies

Power Converter with Digital Filter Feedback Control presents a logical sequence that leads to the identification, extraction, formulation, conversion, and implementation for the control function needed in electrical power equipment systems. This book builds a bridge for moving a power converter with conventional analog feedback to one with modern digital filter control and enlists the state space averaging technique to identify the core control function in analytical, close form in s-domain (Laplace). It is a useful reference for all professionals and electrical engineers engaged in electrical power

equipment/systems design, integration, and management. Offers logical sequences to identification, extraction, formulation, conversion, and implementation for the control function needed Contains step-by-step instructions on how to take existing analog designed power processors and move them to the digital realm Presents ways to extract gain functions for many power converters' power processing stages and their supporting circuitry

Monthly Catalogue, United States Public Documents

The papers presented at the Symposium covered the areas in aerospace technology where automatic control plays a vital role. These included navigation and guidance, space robotics, flight management systems and satellite orbital control systems. The information provided reflects the recent developments and technical advances in the application of automatic control in space technology.

Monthly Catalog of United States Government Publications

Finding an alternative to supplement military ways of resolving international conflicts has been taken up by many people skilled in various areas such as political science, economics, social studies, modelling and simulation, artificial intelligence and expert systems, military strategy and weaponry as well as private business and industry. The Workshop will therefore be of use as it looks at various control methods which would create a conciliatory social and political environment or climate for seeking and obtaining non-military solutions to international conflicts and to solutions to national conflicts which may lead to international conflicts.

Technology for Large Space Systems

Considers the application of modern control engineering on digital computers with a view to improving productivity and product quality, easing supervision of industrial processes and reducing energy consumption and pollution. The topics covered may be divided into two main subject areas: (1) applications of digital control - in the chemical and oil industries, in water turbines, energy and power systems, robotics and manufacturing, cement, metallurgical processes, traffic control, heating and cooling; (2) systems theoretical aspects of digital control - adaptive systems, control aspects, multivariable systems, optimization and reliability, modelling and identification, real-time software and languages, distributed systems and data networks. Contains 84 papers.

Spacecraft Power Systems

Masters Theses in the Pure and Applied Sciences was first conceived, published, and dis· seminated by the Center for Information and Numerical Data Analysis and Synthesis (CINDAS) *at Purdue University in 1957, starting its coverage of theses with the academic year 1955. Beginning with Volume 13, the printing and dissemination phases of the ac· tivity were transferred to University Microfilms/Xerox of Ann Arbor, Michigan, with the thought that such an arrangement would be more beneficial to the academic and general scientific and technical community. After five years of this joint undertaking we had concluded that it was in the interest of all concerned if the printing and distribution of the volume were handled by an international publishing house to assure improved service and broader dissemination. Hence, starting with Volume 18, Masters Theses in the Pure and Applied Sciences has been disseminated on a worldwide basis by Plenum Publishing Corporation of New York, and in the same year the coverage was broadened to include Canadian universities. All back issues can also be ordered from Plenum. We have reported in Volume 20 (thesis year 1975) a total of 10,374 theses titles from 28 Canadian and 239 United States universities. We are sure that this broader base for theses titles reported will greatly enhance the value of this important annual reference work. The organization of Volume 20 is identical to that of past years. It consists of theses titles arranged by discipline and by university within each discipline.

NASA SP.

Applications of Nonlinear Programming to Optimization and Control is a collection of papers presented at the Fourth International Federation of Automatic Control Workshop by the same title, held in San Francisco, California on June 20-21, 1983. This workshop aims to exchange information on the applications of optimization and nonlinear programming techniques to real-life control problems, to investigate ideas that arise from these exchanges, and to look for advances in nonlinear programming that are useful in solving control problems. This book is divided into 16 chapters. It covers a wide range of related

topics, starting with computer-aided-design of practical control systems, continuing through advanced work on quasi-Newton methods and gradient restoration algorithms. Other chapters provide specific examples, which apply these methods to representative problems. The remaining chapters present examples, including trajectory optimization, optimal design of a structure for a satellite, identification of hovercraft characteristics, determination of optimal electricity generation, and optimal automatic transmission for road vehicles. This book is of value to computer scientists and mathematicians.

Power Converter with Digital Filter Feedback Control

The workshop brought together international experts in the field of robust adaptive control to present recent developments in the area. These indicated that the theory of adaptive control is moving closer to applications and is beginning to give realistic guidelines useful in practical situations. The proceedings also focused on the value of such practical features as filtering, normalization, deadzones and unification of robust control and adaptation.

A Selected Listing of NASA Scientific and Technical Reports for ...

This document, when followed in its entirety, will yield a robust EPS design suitable for very high-reliability space missions. This document specifies general design practices and sets minimum verification and validation requirements for power systems of unmanned spacecraft. The focus of the document is on earth orbiting satellites using traditional photovoltaic/battery power, but does not exclude other primary power generation and storage methods. This document does not address specific launch vehicle requirements however much of the design philosophy used here is applicable to launch vehicle power systems.

Space Station Systems

This book presents the reader, whether an electrical engineering student in power electronics or a design engineer, a selection of power converter control problems and their basic digital solutions, based on the most widespread digital control techniques. The presentation is primarily focused on different applications of the same power converter topology, the half-bridge voltage source inverter, considered both in its single- and three-phase implementation. This is chosen as the test case because, besides being simple and well known, it allows the discussion of a significant spectrum of the most frequently encountered digital control applications in power electronics, from digital pulse width modulation (DPWM) and space vector modulation (SVM), to inverter output current and voltage control, ending with the relatively more complex VSI applications related to the so called smart-grid scenario. This book aims to serve two purposes: (1) to give a basic, introductory knowledge of the digital control techniques applied to power converters; and (2) to raise the interest for discrete time control theory, stimulating new developments in its application to switching power converters.

Government Reports Announcements & Index

Presents Fundamentals of Modeling, Analysis, and Control of Electric Power Converters for Power System Applications Electronic (static) power conversion has gained widespread acceptance in power systems applications; electronic power converters are increasingly employed for power conversion and conditioning, compensation, and active filtering. This book presents the fundamentals for analysis and control of a specific class of high-power electronic converters—the three-phase voltage-sourced converter (VSC). Voltage-Sourced Converters in Power Systems provides a necessary and unprecedented link between the principles of operation and the applications of voltage-sourced converters. The book: Describes various functions that the VSC can perform in electric power systems Covers a wide range of applications of the VSC in electric power systems—including wind power conversion systems Adopts a systematic approach to the modeling and control design problems Illustrates the control design procedures and expected performance based on a comprehensive set of examples and digital computer time-domain simulation studies This comprehensive text presents effective techniques for mathematical modeling and control design, and helps readers understand the procedures and analysis steps. Detailed simulation case studies are included to highlight the salient points and verify the designs. Voltage-Sourced Converters in Power Systems is an ideal reference for senior undergraduate and graduate students in power engineering programs, practicing engineers who deal with grid integration and operation of distributed energy resource units, design engineers, and researchers in the area of electric power generation, transmission, distribution, and utilization.

Large Space Structures & Systems in the Space Station Era

June issues, 1941-44 and Nov. issue, 1945, include a buyers' guide section.

NASA Technical Memorandum

The development of software is described to aid in design and analysis of AC power systems for large spacecraft. The algorithm is an important version of harmonic power flow program, HARMFLO, used for the study of AC power quality. The new program is applicable to three-phase systems typified by terrestrial power systems, and single-phase systems characteristic of space power systems. The modified HARMFLO accommodates system operating frequencies ranging from terrestrial 60 Hz to and beyond aerospace 20 kHz, and can handle both source and load-end harmonic distortions. Comparison of simulation and test results of a representative spacecraft power system shows a satisfactory correlation. Recommendations are made for the direction of future improvements to the software, to enhance its usefulness to power system designer and analysts. Kraft, L. Alan and Kankam, M. David Glenn Research Center RTOP 506-41-41...

Automatic Control in Aerospace 1989

International Conflict Resolution Using System Engineering (SWIIS)