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Fractional-order Systems and Controls details the use of fractional calculus in the description and modeling of systems, and in a range of control design and practical applications. It is largely self-contained, covering the fundamentals of fractional calculus together with some analytical and numerical techniques and providing MATLAB® codes for the simulation of fractional-order control (FOC) systems. Many different FOC schemes are presented for control and dynamic systems problems. Practical material relating to a wide variety of applications is also provided. All the control schemes and applications are presented in the monograph with either system simulation results or real experimental results, or both. Fractional-order Systems and Controls provides readers with a basic understanding of FOC concepts and methods, so they can extend their use of FOC in other industrial system applications, thereby expanding their range of disciplines by exploiting this versatile new set of control techniques. Filling a gap in the literature, this book is a presentation of recent results in the field of PID controllers, including their design, analysis, and synthesis. Emphasis is placed on the efficient computation of the entire set of PID controllers achieving stability and various performance specifications, which is important for the development of future software design packages, as well as further capabilities such as adaptive PID design and online implementation. The results presented here are timely given the resurgence of interest in PID controllers and will find widespread application, specifically in the development of computationally efficient tools for PID controller design and analysis. Serving as a catalyst to bridge the theory--practice gap in the control field as well as the classical--modern gap, this monograph is an excellent resource for control, electrical, chemical, and mechanical engineers, as well as researchers in the field of PID controllers. This four-volume set (CCIS 643, 644, 645, 646) constitutes the refereed proceedings of the 16th Asia Simulation Conference and the First Autumn Simulation Multi-Conference, AsiaSim / SCS AutumnSim 2016, held in Beijing, China, in October 2016. The 265 revised full papers presented were carefully reviewed and selected from 651 submissions. The papers in this first volume of the set are organized in topical sections on modeling and simulation theory and methodology; model engineering for system of systems; high performance computing and simulation; modeling and simulation for smart city. The 24th European Symposium on Computer Aided Process Engineering creates an international forum where scientific and industrial contributions of computer-aided techniques are presented with applications in process modeling and simulation, process synthesis and design, operation, and process optimization. The organizers have broadened the boundaries of Process Systems Engineering by inviting contributions at different scales of modeling and demonstrating vertical and horizontal integration. Contributions range from applications at the molecular level to the strategic level of the supply chain and sustainable development. They cover major classical themes, at the same time exploring a new range of applications that address the production of renewable forms of energy, environmental footprints and sustainable use of resources and water. The vast majority of automatic controllers used to compensate industrial processes are PI or PID type. This book comprehensively compiles, using a unified notation, tuning rules for these controllers proposed from 1935 to 2008. The tuning rules are carefully categorized and application information about each rule is given. The book discusses controller architecture and process modeling issues, as well as the performance and robustness of loops compensated with PI or PID controllers. This unique publication brings together in an easy-to-use format material previously published in a large number of papers and books. This wholly revised third edition extends the presentation of PI and PID controller tuning rules, for single variable processes with time delays, to include additional rules compiled since the second edition was published in 2006. The vast majority of automatic controllers used to compensate industrial processes are of PI or PID type. This book comprehensively compiles, using a unified notation, tuning rules for these controllers proposed over the last seven decades (1935-2005). The tuning rules are carefully categorized and application information about each rule is given. The book discusses controller architecture and process modeling issues, as well as the performance and robustness of loops compensated with PI or PID controllers. This unique publication brings together in an easy-to-use format material previously published in a large number of papers and books. This wholly revised second edition extends the

presentation of PI and PID controller tuning rules, for single variable processes with time delays, to include additional rules compiled since the first edition was published in 2003. Sample Chapter(s). Chapter 1: Introduction (17 KB). Contents: Controller Architecture; Tuning Rules for PI Controllers; Tuning Rules for PID Controllers; Performance and Robustness Issues in the Compensation of FOLPD Processes with PI and PID Controllers. Readership: Control engineering researchers in academia and industry with an interest in PID control and control engineering practitioners using PID controllers. The book also serves as a reference for postgraduate and undergraduate students."

Considered one of the most innovative research directions, computational intelligence (CI) embraces techniques that use global search optimization, machine learning, approximate reasoning, and connectionist systems to develop efficient, robust, and easy-to-use solutions amidst multiple decision variables, complex constraints, and tumultuous environments. CI techniques involve a combination of learning, adaptation, and evolution used for intelligent applications. Computational Intelligence Paradigms for Optimization Problems Using MATLAB®/ Simulink® explores the performance of CI in terms of knowledge representation, adaptability, optimality, and processing speed for different real-world optimization problems. Focusing on the practical implementation of CI techniques, this book: Discusses the role of CI paradigms in engineering applications such as unit commitment and economic load dispatch, harmonic reduction, load frequency control and automatic voltage regulation, job shop scheduling, multidepot vehicle routing, and digital image watermarking Explains the impact of CI on power systems, control systems, industrial automation, and image processing through the above-mentioned applications Shows how to apply CI algorithms to constraint-based optimization problems using MATLAB® m-files and Simulink® models Includes experimental analyses and results of test systems Computational Intelligence Paradigms for Optimization Problems Using MATLAB®/ Simulink® provides a valuable reference for industry professionals and advanced undergraduate, postgraduate, and research students. Introduction to Process Control, Second Edition provides a bridge between the traditional view of process control and the current, expanded role by blending conventional topics with a broader perspective of more integrated process operation, control, and information systems. Updating and expanding the content of its predecessor, this second edition addresses issues in today's teaching of process control. Teaching & Learning Principles Presents a concept first followed by an example, allowing students to grasp theoretical concepts in a practical manner Uses the same problem in each chapter, culminating in a complete control design strategy Includes 50 percent more exercises Content Defines the traditional and expanded roles of process control in modern manufacturing Introduces the link between process optimization and process control (optimizing control), including the effect of disturbances on the optimal plant operation, the concepts of steady-state and dynamic backoff as ways to quantify the economic benefits of control, and how to determine an optimal transition policy during a planned production change Incorporates an introduction to the modern architectures of industrial computer control systems with real case studies and applications to pilot-scale operations Discusses the expanded role of process control in modern manufacturing, including model-centric technologies and integrated control systems Integrates data processing/reconciliation and intelligent monitoring in the overall control system architecture Web Resource The book's website offers a user-friendly software environment for interactively studying the examples in the text. The site contains the MATLAB® toolboxes for process control education as well as the main simulation examples from the book. Access the site through the authors' websites at www.pseonline.net and www.chms.ucdavis.edu/research/web/pse/ahmet/ Drawing on the authors' combined 50 years of teaching experiences, this classroom-tested text is designed for chemical engineering students but is also suitable for industrial practitioners who need to understand key concepts of process control and how to implement them. The authors help readers see how traditional process control has evolved into an integrated operational environment used to run modern manufacturing facilities. For the first time in a single reference, this book provides the beginner with a coherent and logical introduction to the hardware and software of the PIC32, bringing together key material from the PIC32 Reference Manual, Data Sheets, XC32 C Compiler User's Guide, Assembler and Linker Guide, MIPS32 CPU manuals, and Harmony documentation. This book also trains you to use the Microchip documentation, allowing better life-long learning of the PIC32. The philosophy is to get you started quickly, but to emphasize fundamentals and to eliminate "magic steps" that prevent a deep understanding of how the software you write connects to the hardware. Applications focus on mechatronics: microcontroller-controlled electromechanical systems incorporating sensors and actuators. To support a learn-by-doing approach, you can follow the examples throughout the book using the sample code and your PIC32 development board. The exercises at the end of each chapter help you put your new skills to practice. Coverage includes: A practical introduction to the C programming language Getting up and running quickly with the PIC32 An exploration of the hardware architecture of the PIC32 and differences among PIC32 families Fundamentals of embedded computing with the PIC32, including the build process, time- and memory-efficient programming, and interrupts A peripheral reference, with extensive sample code covering digital input and output, counter/timers, PWM, analog input, input capture, watchdog timer, and communication by the parallel master port, SPI, I2C, CAN, USB, and UART An introduction to the Microchip Harmony programming framework Essential topics in mechatronics, including interfacing sensors to the PIC32, digital signal processing, theory of operation and control of brushed DC motors, motor

sizing and gearing, and other actuators such as stepper motors, RC servos, and brushless DC motors. For more information on the book, and to download free sample code, please visit <http://www.nu32.org>. Extensive, freely downloadable sample code for the NU32 development board incorporating the PIC32MX795F512H microcontroller. Free online instructional videos to support many of the chapters. This book presents comprehensive information on the relay auto-tuning method for unstable systems in process control industries, and introduces a new, refined Ziegler-Nichols method for designing controllers for unstable systems. The relay auto-tuning method is intended to assist graduate students in chemical, electrical, electronics and instrumentation engineering who are engaged in advanced process control. The book's main focus is on developing a controller tuning method for scalar and multivariable systems, particularly for unstable processes. It proposes a much simpler technique, avoiding the shortcomings of the popular relay-tuning method. The effects of higher-order harmonics are incorporated, owing to the shape of output waveforms. In turn, the book demonstrates the applicability and effectiveness of the Ziegler-Nichols method through simulations on a number of linear and non-linear unstable systems, confirming that it delivers better performance and robust stability in the presence of uncertainty. The proposed method can also be easily implemented across industries with the help of various auto-tuners available on the market. Offering a professional and modern perspective on profitably and efficiently automating controller tuning, the book will be of interest to graduate students, researchers, and industry professionals alike. Digital controllers are part of nearly all modern personal, industrial, and transportation systems. Every senior or graduate student of electrical, chemical, or mechanical engineering should therefore be familiar with the basic theory of digital controllers. This new text covers the fundamental principles and applications of digital control engineering, with emphasis on engineering design. Fadali and Visioli cover analysis and design of digitally controlled systems and describe applications of digital control in a wide range of fields. With worked examples and Matlab applications in every chapter and many end-of-chapter assignments, this text provides both theory and practice for those coming to digital control engineering for the first time, whether as a student or practicing engineer. This new edition covers new topics such as Model Predictive Control and Linear Matrix Inequalities. To engage students, it has more illustrations and simple examples; the mathematical notation is reduced where possible, and it also includes intermediate mathematical steps in derivations. Companion website features resources for instructors, including Powerpoint slides and solutions. Extensive use of CAD Packages: Matlab and Simulink sections at the end of each chapter show how to implement concepts from the chapter. Contains review material to aid understanding of digital control analysis and design. Includes some advanced material to make it suitable for an introductory graduate level class or for two quarters at the senior/graduate level. The mathematics background required for understanding most of the book is based on what can be reasonably expected from the average electrical, chemical, or mechanical engineering senior. Scope of Publication A reference work for process designers and users of decanters, this book aims to bridge the information gap in this field - that between academic theory promoted in student textbooks and case study data in manufacturers sales literature. Design It includes information on design and specification, preparing the reader to select and correctly size equipment. Purchase As a design or project engineer working with vendors to make final equipment selection, this work provides the readers with the full facts before they start talking to product vendors. Supply In an environment of industry consolidation, the handbook allows you to track suppliers old and new, providing a basis on which users can find the new relevant company for the parts/service he/she wishes to purchase. Operation Once an equipment purchase is made, the user needs to be made aware of how to optimally operate decanters. The Decanter Centrifuge Handbook covers relevant (process) operating issues such as instrumentation and control and the use of flocculents. The field of mechatronics (which is the synergistic combination of precision mechanical engineering, electronic control and systems thinking in the design of products and manufacturing processes) is gaining much attention in industries and academics. It was detected that the topics of computer vision, control and robotics are imperative for the successful of mechatronics systems. This book includes several chapters which report successful study cases about computer vision, control and robotics. The readers will have the latest information related to mechatronics, that contains the details of implementation, and the description of the test scenarios. The effectiveness of proportional-integral-derivative (PID) controllers for a large class of process systems has ensured their continued and widespread use in industry. Similarly there has been a continued interest from academia in devising new ways of approaching the PID tuning problem. To the industrial engineer and many control academics this work has previously appeared fragmented; but a key determinant of this literature is the type of process model information used in the PID tuning methods. PID Control presents a set of coordinated contributions illustrating methods, old and new, that cover the range of process model assumptions systematically. After a review of PID technology, these contributions begin with model-free methods, progress through non-parametric model methods (relay experiment and phase-locked-loop procedures), visit fuzzy-logic- and genetic-algorithm-based methods; introduce a novel subspace identification method before closing with an interesting set of parametric model techniques including a chapter on predictive PID controllers. Highlights of PID Control include: an introduction to PID control technology features and typical industrial implementations; chapter contributions ordered by the increasing quality of the model information used; novel PID control concepts for multivariable processes. PID

Control will be useful to industry-based engineers wanting a better understanding of what is involved in the steps to a new generation of PID controller techniques. Academics wishing to have a broader perspective of PID control research and development will find useful pedagogical material and research ideas in this text. The introduction of the microprocessor in computer and system engineering has motivated the development of many new concepts and has simplified the design of many modern industrial systems. During the first decade of their life, microprocessors have shown a tremendous evolution in all possible directions (technology, power, functionality, I/O handling, etc). Of course putting the microprocessors and their environmental devices into properly operating systems is a complex and difficult task requiring high skills for melding and integrating hardware, and systemic components, software. This book was motivated by the editors' feeling that a cohesive reference is needed providing a good coverage of modern industrial applications of microprocessor-based real time control, together with latest advanced methodological issues. Unavoidably a single volume cannot be exhaustive, but the present book contains a sufficient number of important real-time applications. The book is divided in two sections. Section I deals with general hardware, software and systemic topics, and involves six chapters. Chapter 1, by Gupta and Toong, presents an overview of the development of microprocessors during their first twelve years of existence. Chapter 2, by Dasgupta, deals with a number of system software concepts for real time microprocessor-based systems (task scheduling, memory management, input-output aspects, programming language requirements. Theory and Design for Mechanical Measurements merges time-tested pedagogy with current technology to deliver an immersive, accessible resource for both students and practicing engineers. Emphasizing statistics and uncertainty analysis with topical integration throughout, this book establishes a strong foundation in measurement theory while leveraging the e-book format to increase student engagement with interactive problems, electronic data sets, and more. This new Seventh edition has been updated with new practice problems, electronically accessible solutions, and dedicated Instructor Problems that ease course planning and assessment. Extensive coverage of device selection, test procedures, measurement system performance, and result reporting and analysis sets the field for generalized understanding, while practical discussion of data acquisition hardware, infrared imaging, and other current technologies demonstrate real-world methods and techniques. Designed to align with a variety of undergraduate course structures, this unique text offers a highly flexible pedagogical framework while remaining rigorous enough for use in graduate studies, independent study, or professional reference. Control Engineering "An Introductory Course" is aimed at second or third year courses in Electrical and Mechanical Engineering, and provides for the needs of these courses without being over-burdened with detail. The authors work in one of the foremost centres in Europe for Control Engineering, and bring both teaching and practical consultancy experience to the text, which links theoretical approaches to actual case histories. Including an introduction to the software tools of MATLAB and SIMULINK, this book also includes simulations and examples throughout, and will give a straightforward and no-nonsense introduction to Control Engineering for students, and those wishing to refresh their knowledge. This textbook presents mechatronics through an integrated approach covering instrumentation, circuits and electronics, computer-based data acquisition and analysis, analog and digital signal processing, sensors, actuators, digital logic circuits, microcontroller programming and interfacing. The use of computer programming is emphasized throughout the text, and includes Matlab for system modeling, simulation, and analysis; LabVIEW for data acquisition and signal processing; and C++ for Arduino-based microcontroller programming and interfacing. Prof. Samanta provides numerous examples along with appropriate program codes, for simulation and analysis, that are discussed in detail to illustrate the concepts covered in each section. The book also includes the illustration of theoretical concepts through the virtual simulation platform Tinkercad to provide students virtual lab experience. This unique and up-to-date work surveys the use of mechatronics in rail vehicles, notably traction, braking, communications, data sharing, and control. The results include improved safety, comfort, and fuel efficiency. Mechatronic systems are a key element in modern rail vehicle design and operation. Starting with an overview of mechatronic theory, the book goes on to cover topics including modeling of mechanical and electrical systems for rail vehicles, open and closed loop control systems, sensors, actuators and microprocessors. Modern simulation techniques and examples are included throughout, and numerical experiments and developed models for railway application are presented and explained. Case studies are used, alongside practical examples, to ensure that the reader can apply mechatronic theory to real world conditions. These case studies include modeling of a hybrid locomotive and simplified models of railway vehicle lateral dynamics for suspension control studies. Rail Vehicle Mechatronics provides current and in-depth content for design engineers, operations managers, systems engineers and technical consultants world-wide, working with freight, passenger, and urban transit railway systems. This book provides the reader with a complete coverage of radio resource management for 3G wireless communications Systems Engineering in Wireless Communications focuses on the area of radio resource management in third generation wireless communication systems from a systems engineering perspective. The authors provide an introduction into cellular radio systems as well as a review of radio resource management issues. Additionally, a detailed discussion of power control, handover, admission control, smart antennas, joint optimization of different radio resources, and cognitive radio networks is offered. This book differs from books currently available,

with its emphasis on the dynamical issues arising from mobile nodes in the network. Well-known control techniques, such as least squares estimation, PID control, Kalman filters, adaptive control, and fuzzy logic are used throughout the book. Key Features: Covers radio resource management of third generation wireless communication systems at a systems level First book to address wireless communications issues using systems engineering methods Offers the latest research activity in the field of wireless communications, extending to the control engineering community Includes an accompanying website containing MATLABM/SIMULINKTM exercises Provides illustrations of wireless networks This book will be a valuable reference for graduate and postgraduate students studying wireless communications and control engineering courses, and R&D engineers. The complete control system engineering solution for continuous and batch manufacturing plants. This book presents a complete methodology of control system design for continuous and batch manufacturing in such diverse areas as pulp and paper, petrochemical, chemical, food, pharmaceutical, and biochemical production. Geared to practicing engineers faced with designing increasingly more sophisticated control systems in response to present-day economic and regulatory pressures, Plantwide Process Control focuses on the engineering portion of a plant automation improvement project. It features a full control design information package (Control Requirements Definition or CRD), and guides readers through all steps of the automation process—from the initial concept to design, simulation, testing, implementation, and operation. This unique and practical resource: * Integrates continuous, batch, and discrete control techniques. * Shows how to use the methodology with any automation project—existing or new, simple or complex, large or small. * Relates recent ISO and ISA standards to the discipline of control engineering. * Illustrates the methodology with a pulp-and-paper mill case study. * Incorporates numerous other examples, from single-loop controllers to multivariable controllers. Develop an extendable smart robot capable of performing a complex series of actions with Python and Raspberry Pi Key FeaturesGet up to speed with the fundamentals of robotic programming and build intelligent robotsLearn how to program a voice agent to control and interact with your robot's behaviorEnable your robot to see its environment and avoid barriers using sensorsBook Description We live in an age where the most complex or repetitive tasks are automated. Smart robots have the potential to revolutionize how we perform all kinds of tasks with high accuracy and efficiency. With this second edition of Learn Robotics Programming, you'll see how a combination of the Raspberry Pi and Python can be a great starting point for robot programming. The book starts by introducing you to the basic structure of a robot and shows you how to design, build, and program it. As you make your way through the book, you'll add different outputs and sensors, learn robot building skills, and write code to add autonomous behavior using sensors and a camera. You'll also be able to upgrade your robot with Wi-Fi connectivity to control it using a smartphone. Finally, you'll understand how you can apply the skills that you've learned to visualize, lay out, build, and code your future robot building projects. By the end of this book, you'll have built an interesting robot that can perform basic artificial intelligence operations and be well versed in programming robots and creating complex robotics projects using what you've learned. What you will learnLeverage the features of the Raspberry Pi OSDiscover how to configure a Raspberry Pi to build an AI-enabled robotInterface motors and sensors with a Raspberry PiCode your robot to develop engaging and intelligent robot behaviorExplore AI behavior such as speech recognition and visual processingFind out how you can control AI robots with a mobile phone over Wi-FiUnderstand how to choose the right parts and assemble your robotWho this book is for This second edition of Learn Robotics Programming is for programmers, developers, and robotics enthusiasts who want to develop a fully functional robot and leverage AI to build interactive robots. Basic knowledge of the Python programming language will help you understand the concepts covered in this robot programming book more effectively. The main objectives of 2013 International Conference on Transportation (ICTR2013) are to bring together representatives of transportation engineering , of various institutions, universities, industry and professional associations, to debate and exchange experience on important conference topics. Another main objective of ICTR2013 consists of providing a good networking opportunity to all these groups. The ICTR2013 became a major conference to exchange new ideas of transportation in Asia researchers and provide a form to present their new results in transportation engineering, vehicle operation engineering, transportation planning, traffic information engineering and control, pavement and bridge engineering and other related topics. ICTR2013 is held in Xianning, China from December 4 to 6, 2013 sponsored by Shanghai Jiaotong University and DES Tech Publishing Inc. In the first edition of the ICTR2013 189 papers were submitted, 69 of which were accepted . In addition to the authors that were present at the conference, researchers from universities and institutions also send papers. The organizing committee hopes this conference proceedings will provide readers a broad overview of the latest advances on transportation. The organizing committee also believes this conference proceedings would be a good reference for academic researchers and industrial professionals in these fields. The ICTR2013 organizing committee would like to express our sincere appreciations to all authors for their contributions to this conference. We would like to extend our thanks to all the referees for their constructive comments on all papers. Finally, we would like to thank DES Tech publishing Inc . for producing this conference proceeding. We hope you will have a unique, rewarding and enjoyable weekend at ICTR2013 in Xianning, China. Control Systems: Classical, Modern, and AI-Based Approaches provides a broad and

comprehensive study of the principles, mathematics, and applications for those studying basic control in mechanical, electrical, aerospace, and other engineering disciplines. The text builds a strong mathematical foundation of control theory of linear, nonlinear, optimal, model predictive, robust, digital, and adaptive control systems, and it addresses applications in several emerging areas, such as aircraft, electro-mechanical, and some nonengineering systems: DC motor control, steel beam thickness control, drum boiler, motion control system, chemical reactor, head-disk assembly, pitch control of an aircraft, yaw-damper control, helicopter control, and tidal power control. Decentralized control, game-theoretic control, and control of hybrid systems are discussed. Also, control systems based on artificial neural networks, fuzzy logic, and genetic algorithms, termed as AI-based systems are studied and analyzed with applications such as auto-landing aircraft, industrial process control, active suspension system, fuzzy gain scheduling, PID control, and adaptive neuro control. Numerical coverage with MATLAB® is integrated, and numerous examples and exercises are included for each chapter. Associated MATLAB® code will be made available. A timely introduction to current research on PID and predictive control by one of the leading authors on the subject PID and Predictive Control of Electric Drives and Power Supplies using MATLAB/Simulink examines the classical control system strategies, such as PID control, feed-forward control and cascade control, which are widely used in current practice. The authors share their experiences in actual design and implementation of the control systems on laboratory test-beds, taking the reader from the fundamentals through to more sophisticated design and analysis. The book contains sections on closed-loop performance analysis in both frequency domain and time domain, presented to help the designer in selection of controller parameters and validation of the control system. Continuous-time model predictive control systems are designed for the drives and power supplies, and operational constraints are imposed in the design. Discrete-time model predictive control systems are designed based on the discretization of the physical models, which will appeal to readers who are more familiar with sampled-data control system. Soft sensors and observers will be discussed for low cost implementation. Resonant control of the electric drives and power supply will be discussed to deal with the problems of bias in sensors and unbalanced three phase AC currents. Brings together both classical control systems and predictive control systems in a logical style from introductory through to advanced levels Demonstrates how simulation and experimental results are used to support theoretical analysis and the proposed design algorithms MATLAB and Simulink tutorials are given in each chapter to show the readers how to take the theory to applications. Includes MATLAB and Simulink software using xPC Target for teaching purposes A companion website is available Researchers and industrial engineers; and graduate students on electrical engineering courses will find this a valuable resource. Covers PID control systems from the very basics to the advanced topics This book covers the design, implementation and automatic tuning of PID control systems with operational constraints. It provides students, researchers, and industrial practitioners with everything they need to know about PID control systems—from classical tuning rules and model-based design to constraints, automatic tuning, cascade control, and gain scheduled control. PID Control System Design and Automatic Tuning using MATLAB/Simulink introduces PID control system structures, sensitivity analysis, PID control design, implementation with constraints, disturbance observer-based PID control, gain scheduled PID control systems, cascade PID control systems, PID control design for complex systems, automatic tuning and applications of PID control to unmanned aerial vehicles. It also presents resonant control systems relevant to many engineering applications. The implementation of PID control and resonant control highlights how to deal with operational constraints. Provides unique coverage of PID Control of unmanned aerial vehicles (UAVs), including mathematical models of multi-rotor UAVs, control strategies of UAVs, and automatic tuning of PID controllers for UAVs Provides detailed descriptions of automatic tuning of PID control systems, including relay feedback control systems, frequency response estimation, Monte-Carlo simulation studies, PID controller design using frequency domain information, and MATLAB/Simulink simulation and implementation programs for automatic tuning Includes 15 MATLAB/Simulink tutorials, in a step-by-step manner, to illustrate the design, simulation, implementation and automatic tuning of PID control systems Assists lecturers, teaching assistants, students, and other readers to learn PID control with constraints and apply the control theory to various areas. Accompanying website includes lecture slides and MATLAB/Simulink programs PID Control System Design and Automatic Tuning using MATLAB/Simulink is intended for undergraduate electrical, chemical, mechanical, and aerospace engineering students, and will greatly benefit postgraduate students, researchers, and industrial personnel who work with control systems and their applications. The objective of this book is to provide a collection of solved problems on control systems, with an emphasis on practical problems. System functionality is described, the modeling process is explained, the problem solution is introduced, and the derived results are discussed. Each chapter ends with a discussion on applying MATLAB®, LabVIEW, and/or Comprehensive Control to the previously introduced concepts. The aim of the book is to help an average reader understand the concepts of control systems through problems and applications. The solutions are based directly on math formulas given in extensive tables throughout the text. Providing a thorough introduction to the field of soft computing techniques, Intelligent Systems: Modeling, Optimization, and Control covers every major technique in artificial intelligence in a clear and practical style. This book highlights current research and applications, addresses

issues encountered in the development of applied systems, and describes a wide range of intelligent systems techniques, including neural networks, fuzzy logic, evolutionary strategy, and genetic algorithms. The book demonstrates concepts through simulation examples and practical experimental results. Case studies are also presented from each field to facilitate understanding. This book contains enhanced way of battery charging that increases battery durability where energy source is variable such as solar, wind, tidal energy etc. The charging algorithm is applied to enhance durability of a lead acid battery charged by a photovoltaic cell. Batteries are charged best when it is charged in three different stages. In this method, battery is first charged with trickle current, after a certain voltage it is charged with bulk charging current then again after a certain voltage it is charged with a constant voltage. The current and the voltage supplied by the variable source is unpredictable. To maintain the desired current and voltage at different times a DC-DC converter is used. A micro-controller is to be used to control the gate pulse of DC-DC converter to control battery charging current and voltage. This charging technique can be used for various applications like Hybrid Electric Vehicle battery charging, Head light battery charging of coalmine workers, solar panel charged batteries used for domestic purpose etc. This e-book is a compilation of 170 articles presented at the 7th Mechanical Engineering Research Day (MERD'20) - Kampus Teknologi UTeM (virtual), Melaka, Malaysia on 16 December 2020. The early 21st century has seen a renewed interest in research in the widely-adopted proportional-integral-differential (PID) form of control. PID Control in the Third Millennium provides an overview of the advances made as a result. Featuring: new approaches for controller tuning; control structures and configurations for more efficient control; practical issues in PID implementation; and non-standard approaches to PID including fractional-order, event-based, nonlinear, data-driven and predictive control; the nearly twenty chapters provide a state-of-the-art resumé of PID controller theory, design and realization. Each chapter has specialist authorship and ideas clearly characterized from both academic and industrial viewpoints. PID Control in the Third Millennium is of interest to academics requiring a reference for the current state of PID-related research and a stimulus for further inquiry. Industrial practitioners and manufacturers of control systems with application problems relating to PID will find this to be a practical source of appropriate and advanced solutions. This book deals with evolving intelligence systems and their use in immune algorithm (IM), particle swarm optimization (PSO), bacterial foraging (BF), and hybrid intelligent system to improve plants, robots, etc. It discusses the motivation behind research on and background of evolving intelligence systems and illustrates IM-based approach for parameter estimation required for designing an intelligent system. It approaches optimal intelligent tuning using a hybrid genetic algorithm–particle swarm optimization (GA-PSO) and illustrates hybrid GA-PSO for intelligent tuning of vector system. This book trains engineering students to identify multivariable transfer function models and design classical controllers for such systems. The three-volume set CCIS 1467, CCIS 1468, and CCIS 1469 constitutes the thoroughly refereed proceedings of the 7th International Conference on Life System Modeling and Simulation, LSMS 2021, and of the 7th International Conference on Intelligent Computing for Sustainable Energy and Environment, ICSEE 2021, held in Hangzhou, China, in October 2021. The 159 revised papers presented were carefully reviewed and selected from over 430 submissions. The papers of this volume are organized in topical sections on: Medical Imaging and Analysis Using Intelligence Computing; Biomedical signal processing, imaging, visualization and surgical robotics; Computational method in taxonomy study and neural dynamics; Intelligent medical apparatus, clinical applications and intelligent design of biochips; Power and Energy Systems; Computational Intelligence in Utilization of Clean and Renewable Energy Resources, and Intelligent Modelling, Control and Supervision for Energy Saving and Pollution Reduction; Intelligent Methods in Developing Electric Vehicles, Engines and Equipment; Intelligent Control Methods in Energy Infrastructure Development and Distributed Power Generation Systems; Intelligent Modeling, Simulation and Control of Power Electronics and Power Networks; Intelligent Techniques for Sustainable Energy and Green Built Environment, Water Treatment and Waste Management; Intelligent Robot and Simulation; Intelligent Data Processing, Analysis and Control in Complex Systems; Advanced Neural Network Theory and Algorithms; Advanced Computational Methods and Applications; Fuzzy, Neural, and Fuzzy-neuro Hybrids; Intelligent Modelling, Monitoring, and Control of Complex Nonlinear Systems; Intelligent manufacturing, autonomous systems, intelligent robotic systems; Computational Intelligence and Applications. This book presents the study to design, develop, and implement improved PI control techniques using dead-time compensation, structure enhancements, learning functions and fractional ordering parameters. Two fractional-order PI controllers are proposed and designed: fractional-order predictive PI and hybrid iterative learning based fractional-order predictive PI controller. Furthermore, the proposed fractional-order control strategies and filters are simulated over first- and second-order benchmark process models and further validated using the real-time experimentation of the pilot pressure process plant. In this book, five chapters are structured with a proper sequential flow of details to provide a better understanding for the readers. A general introduction to the controllers, filters and optimization techniques is presented in Chapter 1. Reviews of the PI controllers family and their modifications are shown in the initial part of Chapter 2, followed by the development of the proposed fractional-order predictive PI (FOPPI) controller with dead-time compensation ability. In the first part of chapter 3, a review of the PI based iterative learning controllers, modified structures

of the ILC and their modifications are presented. Then, the design of the proposed hybrid iterative learning controller-based fractional-order predictive PI controller based on the current cyclic feedback structure is presented. Lastly, the results and discussion of the proposed controller on benchmark process models and the real-time experimentation of the pilot pressure process plant are given. Chapter 4 presents the development of the proposed filtering techniques and their performance comparison with the conventional methods. Chapter 5 proposes the improvement of the existing sine cosine algorithm (SCA) and arithmetic optimization algorithm (AOA) to form a novel arithmetic-trigonometric optimization algorithm (ATOA) to accelerate the rate of convergence in lesser iterations with mitigation towards getting caught in the same local position. The performance analysis of the optimization algorithm will be carried out on benchmark test functions and the real-time pressure process plant. The subject of this book is the current comprehensive research and development of soft actuators, and encompasses interdisciplinary studies of materials science, mechanics, electronics, robotics and bioscience. As an example, the book includes current research on actuators based on biomaterials to provide future perspectives for artificial muscle technology. Readers can obtain detailed, useful information about materials, methods of synthesis, fabrication and measurements. The topics covered here not only promote further research and development of soft actuators but also lead the way to their utilization and industrialization. One outstanding feature of the book is that it contains many color figures, diagrams and photographs clearly describing the mechanism, apparatus and motion of soft actuators. The chapter on modeling is conducive to more extensive design work in materials and devices and is especially useful in the development of practical applications. Readers can acquire the newest technology and information about the basic science and practical applications of flexible, lightweight and noiseless soft actuators, which are quite unlike conventional mechanical engines and electric motors. The new ideas offered in this volume will provide inspiration and encouragement to researchers and developers as they explore new fields of applications for soft actuators. The increased efficiency and quality constraints imposed on electrical energy systems have inspired a renewed research interest in the study of formal approaches to the analysis and control of power electronics converters. Switched systems represent a useful framework for modeling these converters and the peculiarities of their operating conditions and control goals justify the specific classification of “switched electronic systems”. Indeed, idealized switched models of power converters introduce problems not commonly encountered when analyzing generic switched models or non-switched electrical networks. In that sense the analysis of switched electronic systems represents a source for new ideas and benchmarks for switched and hybrid systems generally. Dynamics and Control of Switched Electronic Systems draws on the expertise of an international group of expert contributors to give an overview of recent advances in the modeling, simulation and control of switched electronic systems. The reader is provided with a well-organized source of references and a mathematically-based report of the state of the art in analysis and design techniques for switched power converters. Intuitive language, realistic illustrative examples and numerical simulations help the reader to come to grips with the rigorous presentation of many promising directions of research such as: converter topologies and modulation techniques; continuous-time, discrete-time and hybrid models; modern control strategies for power converters; and challenges in numerical simulation. The guidance and information imparted in this text will be appreciated by engineers, and applied mathematicians working on system and circuit theory, control systems development, and electronic and energy conversion systems design. OPTIMIZATION OF INDUSTRIAL SYSTEMS Including the latest industrial solution-based practical applications, this is the most comprehensive and up-to-date study of the optimization of industrial systems for engineers, scientists, students, and other professionals. In order to deal with societal challenges, novel technologies play an important role. For the advancement of technology, it is essential to share innovative ideas and thoughts on a common platform where researchers across the globe meet together and revitalize their knowledge and skills to tackle the challenges that the world faces. The high complexity of the issues related to societal interdisciplinary research is the key to future revolutions. From research funders to journal editors, policymakers to think tanks, all seem to agree that the future of research lies outside disciplinary boundaries. In such prevailing conditions, various working scenarios, conditions, and strategies need to be optimized. Optimization is a multidisciplinary term, and its essence can be inculcated in any domain of business, research, and other associated working dynamics. Globalization provides all-around development, and this development is impossible without technological contributions. This volume’s mission is at the core of industrial engineering. All the manuscripts appended in this volume were double-blind peer-reviewed by committee members and the review team, promising high-quality research. This book provides deep insights to its readers about the current scenarios and future advancements of industrial engineering. This book comprises the select peer-reviewed proceedings of the National Conference on Renewable Energy and Sustainable Environment (NCRESE) 2019. The book brings together the latest developments in harvesting, storing and optimizing alternate and renewable energy resources. It covers latest developments in green energy technologies as well as smart grids, and their applications towards a sustainable environment. The book can be useful for beginners, academicians, entrepreneurs, and professionals interested in renewable energy technologies and sustainable environment practices.

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