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Gathering presentations to the First International Conference on Cable-Driven Parallel Robots, this book covers classification and definition, kinematics, workspace analysis, cable modeling, hardware/prototype development, control and calibration and more.

Different control laws have been analyzed, from the classical theory, like PD and LQR controllers, to an innovative theory, that is represented by the L1 adaptive controller. The validation of controllers is proposed on the experimental model (derived from flight tests) and in a formation flight application. A quadrotor is a platform with fast dynamics, thus if a sudden maneuver is implemented can cause glitches on the parameters trend and the aircraft could become uncontrollable. A key aspect of this controller is the definition of control signals as the output of a low pass-filter. This feature permits to avoid high frequency oscillations due to the large adaptation gain; in systems that use electronic devices. Moreover, this controller is robust in presence of model uncertainties and unmodeled dynamics. The simple structure and the presence of less oscillations during the implementation demonstrate that this controller can be a good candidate for an autopilot. Therefore, the low pass filter is evaluated by a trial and error method. To provide a systematic method, a mixed deterministic - randomized approach for the control law design (low pass filter) is proposed.

Presented in a tutorial style, this comprehensive treatment unifies, simplifies, and explains most of the techniques for designing and analyzing adaptive control systems. Numerous examples clarify procedures and methods. 1995 edition.

Designed to meet the needs of a wide audience without sacrificing mathematical depth and rigor, Adaptive Control Tutorial presents the design, analysis, and application of a wide variety of algorithms that can be used to manage dynamical systems with unknown parameters. Its tutorial-style presentation of the fundamental techniques and algorithms in adaptive control make it suitable as a textbook. Adaptive Control Tutorial is designed to serve the needs of three distinct groups of readers: engineers and students interested in learning how to design, simulate, and implement parameter estimators and adaptive control schemes without having to fully understand the analytical and technical proofs; graduate students who, in addition to attaining the aforementioned objectives, also want to understand the analysis of simple schemes and get an idea of the steps involved in more complex proofs; and advanced students and researchers who want to study and understand the details of long and technical proofs with an eye toward pursuing research in adaptive control or related topics. The authors achieve these multiple objectives by enriching the book with examples demonstrating the design procedures and basic analysis steps and by detailing their proofs in both an appendix and electronically available supplementary material; online examples are also available. A solution manual for instructors can be obtained by contacting SIAM or the authors. Preface; Acknowledgements; List of Acronyms; Chapter 1: Introduction; Chapter 2: Parametric Models; Chapter 3: Parameter Identification: Continuous Time; Chapter 4: Parameter Identification: Discrete Time; Chapter 5: Continuous-Time Model Reference Adaptive Control; Chapter 6: Continuous-Time Adaptive Pole Placement Control; Chapter 7: Adaptive Control for Discrete-Time Systems; Chapter 8: Adaptive Control of Nonlinear Systems; Appendix; Bibliography; Index

Robust and Adaptive Control shows the reader how to produce consistent and accurate controllers that operate in the presence of uncertainties and unforeseen events. Driven by aerospace applications the focus of the book is primarily on continuous-dynamical systems. The text is a three-part treatment, beginning with robust and optimal linear control methods and moving on to a self-contained presentation of the design and analysis of model reference adaptive control (MRAC) for nonlinear uncertain dynamical systems. Recent extensions and modifications to MRAC design are included, as are guidelines for combining robust optimal and MRAC controllers. Features of the text include: · case studies that demonstrate the benefits of robust and adaptive control for piloted, autonomous and experimental aerial platforms; · detailed background material for each chapter to

motivate theoretical developments; · realistic examples and simulation data illustrating key features of the methods described; and · problem solutions for instructors and MATLAB® code provided electronically. The theoretical content and practical applications reported address real-life aerospace problems, being based on numerous transitions of control-theoretic results into operational systems and airborne vehicles that are drawn from the authors' extensive professional experience with The Boeing Company. The systems covered are challenging, often open-loop unstable, with uncertainties in their dynamics, and thus requiring both persistently reliable control and the ability to track commands either from a pilot or a guidance computer. Readers are assumed to have a basic understanding of root locus, Bode diagrams, and Nyquist plots, as well as linear algebra, ordinary differential equations, and the use of state-space methods in analysis and modeling of dynamical systems. Robust and Adaptive Control is intended to methodically teach senior undergraduate and graduate students how to construct stable and predictable control algorithms for realistic industrial applications. Practicing engineers and academic researchers will also find the book of great instructional value.

This book focuses on the applications of robust and adaptive control approaches to practical systems. The proposed control systems hold two important features: (1) The system is robust with the variation in plant parameters and disturbances (2) The system adapts to parametric uncertainties even in the unknown plant structure by self-training and self-estimating the unknown factors. The various kinds of robust adaptive controls represented in this book are composed of sliding mode control, model-reference adaptive control, gain-scheduling, H-infinity, model-predictive control, fuzzy logic, neural networks, machine learning, and so on. The control objects are very abundant, from cranes, aircrafts, and wind turbines to automobile, medical and sport machines, combustion engines, and electrical machines.

This volume surveys the major results and techniques of analysis in the field of adaptive control. Focusing on linear, continuous time, single-input, single-output systems, the authors offer a clear, conceptual presentation of adaptive methods, enabling a critical evaluation of these techniques and suggesting avenues of further development. 1989 edition.

As the capability and utility of robots has increased dramatically with new technology, robotic systems can perform tasks that are physically dangerous for humans, repetitive in nature, or require increased accuracy, precision, and sterile conditions to radically minimize human error. The Robotics and Automation Handbook addresses the major aspects of designing, fabricating, and enabling robotic systems and their various applications. It presents kinetic and dynamic methods for analyzing robotic systems, considering factors such as force and torque. From these analyses, the book develops several controls approaches, including servo actuation, hybrid control, and trajectory planning. Design aspects include determining specifications for a robot, determining its configuration, and utilizing sensors and actuators. The featured applications focus on how the specific difficulties are overcome in the development of the robotic system. With the ability to increase human safety and precision in applications ranging from handling hazardous materials and exploring extreme environments to manufacturing and medicine, the uses for robots are growing steadily. The Robotics and Automation Handbook provides a solid foundation for engineers and scientists interested in designing, fabricating, or utilizing robotic systems.

Recently, it was shown that a standard model reference adaptive controller modified with a suitably tuned projection algorithm ensures robustness (global boundedness) of the overall adaptive system to a class of unmodeled dynamics with minimal restrictions. However, extensive first-principle based arguments and/or analysis of the parameter trajectory is employed. An alternative to such analysis, albeit approximate, is to use the well-known Describing Function (DF) method. In doing so, the analysis of the robust adaptive control problem becomes tractable and resembles that of familiar and classical linear stability analysis.

This dissertation, "An investigation on the application of nonlinear robust adaptive control theory in AC/DC power systems" by Kai-yin, Kenny, Poon, 彭凱賢, was obtained from The University of Hong Kong (Pokfulam, Hong Kong) and is being sold pursuant to Creative Commons: Attribution 3.0 Hong Kong License. The content of this dissertation has not been altered in any way. We have altered the formatting in order to facilitate the ease of printing and reading of the dissertation. All rights not granted by the above license are retained by the author. Abstract: Abstract of thesis entitled "An investigation of the application of nonlinear robust adaptive control theory in AC/DC power systems" submitted by Poon Kai Yin Kenny for the degree of Master of Philosophy at The University of Hong Kong in July 2007 The global trend in power system development advocates the use of interconnected power systems to attain the goal of electricity provision in a safe, economical and reliable manner. In many cases, HVDC transmission is also incorporated into these large systems because of their ability to connect asynchronous areas and the advantages gained during long distance transmission. One of the common issues in large interconnected AC/DC power systems is that of low frequency oscillations along tie lines because of the lack of sufficient damping torque. It is known that dc power modulation control can provide effective damping to inter area oscillations, which helps improve interconnected system synchronous stability. In this thesis, the design of a novel power modulation controller based on advanced nonlinear robust adaptive control theory is presented. The design idea is to drive the center-of-inertia (COI) of various areas to be coherent to each other such that the low frequency oscillations in the system would then be effectively damped out. A coordinated optimization algorithm based on the concepts of genetic algorithms and ordinal optimization is then proposed to optimize the parameters of the proposed modulation controller. A simple 3 area interconnected power system is used as the test system and time simulations are used to analyze and compare the performance of the proposed controller with conventional modulation controllers. Computer programs are developed for parameter optimization incorporated into existing power system analysis programs in MATLAB environment. Computer results illustrate the effectiveness and superiority of the proposed controller in damping oscillations to conventional controllers. The optimization algorithm helps to further enhance the effects of the proposed controller in damping inter-area oscillations and improving interconnected system stability. (275 words) DOI: 10.5353/th_b3889894 Subjects: Robust control Control theory Electric controllers - Design and construction

The authors here provide a detailed treatment of the design of robust adaptive controllers for nonlinear systems with uncertainties. They employ a new tool based on the ideas of system immersion and manifold invariance. New algorithms are delivered for the construction of robust asymptotically-stabilizing and adaptive control laws for nonlinear systems. The methods proposed lead to modular schemes that are easier to tune than their counterparts obtained from Lyapunov redesign.

This research deals with fundamental issues in robust and adaptive control, with emphasis on performance and stability robustness under parametric uncertainty and on the potential applications of such advanced control system design methods to the control of high performance vehicles such as the supermaneuverable aircraft and bank-to-turn missiles. Keywords: Robust adaptive control; Identification in the time and frequency domains; Parametric uncertainty analysis. (edc).

Suitable for advanced undergraduates and graduate students, this overview introduces theoretical and practical aspects of adaptive control, with emphasis on deterministic and stochastic viewpoints. 1995 edition.

The book investigates the role of artificial input delay in approximating unknown system dynamics, referred to as time-delayed control (TDC), and provides novel solutions to current design issues in TDC. Its central focus is on designing adaptive-switching gain-based robust control (ARC) for a class of Euler-Lagrange (EL) systems with minimal or no knowledge of the system dynamics parameters. The newly proposed TDC-based ARC tackles the commonly observed over- and under-estimation issues in switching gain. The consideration of EL systems lends a practical perspective on the

proposed methods, and each chapter is supplemented by relevant experimental data. The book offers a unique resource for researchers in the areas of ARC and TDC alike, and covers the state of the art, new algorithms, and future directions.

Synthesis of Feedback Systems presents the feedback theory which exists in various feedback problems. This book provides techniques for the analysis and solution of these problems. The text begins with an introduction to feedback theory and exposition of problems of plant identification, representation, and analysis. Subsequent chapters are devoted to the application of the feedback point of view to any system; the principal useful properties of feedback; the feedback control system synthesis techniques; and the class of two degree-of-freedom feedback configurations and synthesis procedures appropriate for such configurations. The final chapter considers how to translate specifications from their typical original formulation, to the language appropriate for detailed design. The book is intended for engineers and graduate students of engineering design.

Includes a solution manual for problems. Provides MATLAB code for examples and solutions. Deals with robust systems in both theory and practice.

A treatise on investigating tracking control and synchronization control of fractional-order nonlinear systems with system uncertainties, external disturbance, and input saturation Robust Adaptive Control for Fractional-Order Systems, with Disturbance and Saturation provides the reader with a good understanding on how to achieve tracking control and synchronization control of fractional-order nonlinear systems with system uncertainties, external disturbance, and input saturation. Although some texts have touched upon control of fractional-order systems, the issues of input saturation and disturbances have rarely been considered together. This book offers chapter coverage of fractional calculus and fractional-order systems; fractional-order PID controller and fractional-order disturbance observer; design of fractional-order controllers for nonlinear chaotic systems and some applications; sliding mode control for fractional-order nonlinear systems based on disturbance observer; disturbance observer based neural control for an uncertain fractional-order rotational mechanical system; adaptive neural tracking control for uncertain fractional-order chaotic systems subject to input saturation and disturbance; stabilization control of continuous-time fractional

positive systems based on disturbance observer; sliding mode synchronization control for fractional-order chaotic systems with disturbance; and more. Based on the approximation ability of the neural network (NN), the adaptive neural control schemes are reported for uncertain fractional-order nonlinear systems Covers the disturbance estimation techniques that have been developed to alleviate the restriction faced by traditional feedforward control and reject the effect of external disturbances for uncertain fractional-order nonlinear systems By combining the NN with the disturbance observer, the disturbance observer based adaptive neural control schemes have been studied for uncertain fractional-order nonlinear systems with unknown disturbances Considers, together, the issue of input saturation and the disturbance for the control of fractional-order nonlinear systems in the present of system uncertainty, external disturbance, and input saturation Robust Adaptive Control for Fractional-Order Systems, with Disturbance and Saturation can be used as a reference for the academic research on fractional-order nonlinear systems or used in Ph.D. study of control theory and engineering.

Adaptive control is no longer just an important theoretical field of study, but is also providing solutions to real-world problems. Adaptive techniques will transform the world of control. The leading world practitioners of adaptive control have contributed to this handbook which is the most important work yet in this field. Not only are techniques described in theory, but detailed control algorithms are given, making this a practical cookbook of adaptive control for both control professionals and practising engineers. The book presents the most advanced techniques and algorithms of adaptive control. These include various robust techniques, performance enhancement techniques, techniques with less a-priori knowledge, nonlinear adaptive control techniques and intelligent adaptive techniques. Each technique described has been developed to provide a practical solution to a real-life problem. This volume will therefore not only advance the field of adaptive control as an area of study, but will also show how the potential of this technology can be realised and offer significant benefits. Practical cookbook of adaptive control Contains important research

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 mov-

ing 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.

Contains results not yet published in technical journals and conference proceedings.

This textbook provides readers with a good working knowledge of adaptive control theory through applications. It is intended for students beginning masters or doctoral courses, and control practitioners wishing to get up to speed in the subject expeditiously. Readers are taught a wide variety of adaptive control techniques starting with simple methods and extending step-by-step to more complex ones. Stability proofs are provided for all adaptive control techniques without obfuscating reader understanding with excessive mathematics. The book begins with standard model-reference adaptive control (MRAC) for first-order, second-order, and multi-input, multi-output systems. Treatment of least-squares parameter estimation and its extension to MRAC follow, helping readers to gain a different perspective on MRAC. Function approximation with orthogonal polynomials and neural networks, and MRAC using neural networks are also covered. Robustness issues connected with MRAC are discussed, helping the student to appreciate potential pitfalls of the technique. This appreciation is encouraged by drawing parallels between various aspects of robustness and linear time-invariant systems wherever relevant. Following on from the robustness problems is material covering robust adaptive control including standard methods and detailed exposition of recent advances, in particular, the author's work on optimal control modification. Interesting properties of the new method are illustrated in the design of adaptive systems to meet stability margins. This method has been successfully flight-tested on research aircraft, one of various flight-control applications detailed towards the end of the book along with a hybrid adaptive flight control architecture that combines direct MRAC with least-squares indirect adaptive control. In addition to the applications, understanding is encouraged by the use of end-of-chapter exercises and associated MATLAB® files. Readers will need no more than the standard mathematics for basic control theory such as differential equations and matrix algebra; the book covers the foundations of MRAC and the necessary mathematical preliminaries.