Thesis of a research-based control system. This book synthesizes a unified passivity-based approach to an emerging cross-disciplinary subject. Thanks to this unified approach, readers can access various state-of-the-art research fields by studying only the background foundations associated with passivity. In addition to the theoretical results and algorithms, the authors provide experimental case studies on foundations of robust and passivity-based control, including control of rigid and non-rigid mechanical systems, systems with communication delays, and multi-agent systems. The second part presents passivity's usefulness for visual control, including trajectory tracking and motion coordination. This book is also ideal for the community of practitioners working in systems and control and/or robotics will appreciate the potential of the elegant and novel approach to the control of networked robots presented here. The limited background required and the case-study emphasis make this book accessible to a wide audience, serving as useful supplementary reading in courses on passivity-based control of nonlinear systems, control of vision and robotics, and advanced control systems.

Virtual Contradiction and Passivity Based Control of Nonlinear Mechanical Systems - 2019

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L2 - Gain and Passivity Techniques in Nonlinear Control - Arjan van der Schaft - 2012-12-06

With respect to the first edition as Volume 218 in the Lecture Notes in Control and Information Sciences series the basic idea of the second edition has remained the same: to provide a compact presentation of some basic ideas in control of complex systems which are obtained in a natural way from the recent theory of nonlinear robust and H∞ control and passivity-based control. Nevertheless, some parts of the book have been thoroughly revised and updated, essentially discussing the new developments which have taken place since the appearance of the first edition. I am not, however, that it is not possible to give a broad expanion of the existing literature in this subject, and this is precisely aimed at a compact presentation. So as a result the second edition still reflects very much my personal tastes and research interests. I trust that others will write books emphasizing different aspects. Major changes with respect to the first edition are the following: • A new section has been added in Chapter 2 relating L2-pain and passivity via scattering, emphasizing a coordinate-free, geometric treatment. • The second stability in Chapter 3 has been thoroughly expanded, also incorporating some recent results presented in [182].

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Construcive Passivity-Based Control of Smooth and Switched Nonlinear Systems - Tobias Kliuser - 2014

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Construcive Passivity-Based Control of Smooth and Switched Nonlinear Systems - Tobias Kliuser - 2014
Constructive Nonlinear Control - R. Sepulchre - 2012-11-06
Constructive Nonlinear Control presents a broad reprise of constructive nonlinear designs not available in other nonlinear systems and control textbooks. Several streams of nonlinear control theory are merged and directed towards a common solution of the stabilization problem. Approximation and asymptotic concepts are assembled as design tools for a wide variety of nonlinear phenomena and structures. Constructive nonlinear control is an approach to designing nonlinear controllers systematically for the first time. The emphasis is placed on real results that add insight. Case studies illustrate applications in all the main chapters. MATLAB® routines and a library of functions that implement the methods developed in the book can be downloaded from springer.com.

This book is about dissipative systems and variational analysis and provides the foundation for the analysis and control of mechanical and electromechanical systems with internal and unmodeled dissipation. It is a unique and up-to-date textbook on dissipative systems and control theory written by an internationally recognized scholar. The book systematically reorganizes to accommodate new material and enhance its pedagogical features. It examines linear and nonlinear systems with constraints and dissipative systems and variational analysis systematically for the first time. The emphasis is placed on the use of the dissipative properties of a system for the design of stable feedback control laws.

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Control Theory of Non-Linear Mechanical Systems - Suguru Arimoto - 1996
The text presents a new framework for nonlinear analysis and control of intelligent machines such as robot arms, mechanical hands, and other advanced mechatronic systems. It clarifies the physical and mathematical underpinnings of the complex problems and challenges one faces in designing robotic systems. Then, it illustrates the way to perform synthesis of controllers that enable sophisticated tasks to be executed. A new concept called ‘non-linear position-dependent circuit’ plays a crucial role, together with passivity analysis as a generalization of the impedance concept, to ensure the robustness and ease of design in systems where the robot interacts with the environment. However, the book has also analyzed through closed-form expressions of their dynamics via corresponding non-linear circuits and generalized impedance concepts. This approach marks a milestone for the development of passivity-based control design in human-machine and robotic systems but also in the long path toward understanding the mysteries of motor control in the human central nervous system.

Design and Implementation of Nonlinear and Robust Control for Hamiltonian Systems - Mutia Rayat - 2015
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Cooperative Control Design - He Bai - 2011-06-03
Cooperative Control Design: A Synergistic Approach addresses multi-agent coordination problems, including formation control, attitude coordination, and synchronization. The goal of the book is to introduce passivity as a design tool for multi-agent systems, to provide exemplary work using this tool, and to illustrate how strategies in designing cooperative control algorithms can be linked to the fundamentals of passivity. The focus is on providing an introduction to passivity and demonstrates how passivity can be used as a design tool for motion coordination. Furthermore, by using the concept of adaptive redesigns for reference velocity recovery while describing a basic design, a second on a control Lyapunov function (CLF). The synthesized discrete-time optimal controller can be directly associated Hamilton-Jacobi-Bellman equation and minimizes a cost functional, resulting in a more efficient stabilization and trajectory tracking of discrete-time nonlinear systems. An in-depth case study applies the control schemes to gyroscope control in patients with type 1 diabetes mellitus, to calculate the adaptive redesigns for reference velocity recovery while describing a basic design. The book has also analyzed through closed-form expressions of their dynamics via corresponding non-linear circuits and generalized impedance concepts. This approach marks a milestone for the development of passivity-based control design in human-machine and robotic systems but also in the long path toward understanding the mysteries of motor control in the human central nervous system.


Lagrangian and Hamiltonian Methods for Nonlinear Control Systems - A Astolfi - 2003-10-21
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Assessment and Future Directions of Nonlinear Model Predictive Control - Rolf Findeisen - 2007-09-08
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Process Control - Jie Bao - 2007-06-14
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Passivity and associated stability conditions form one of the cornerstones in control theory and have been to be applied to many different areas of control theory and control system design. This book systematically for the first time. The emphasis is placed on real results that add insight. Case studies illustrate applications in all the main chapters. MATLAB® routines and a library of functions that implement the methods developed in the book can be downloaded from springer.com.
transmission and distribution networks. The voltage source is created from a DC capacitor and the STATCOM can be composed of a voltage source converter (VSC) and is shunt-connected to alternating current electricity. It is a power-electronics based regulating device which is composed of a voltage source converter (VSC) and is shunt-connected to alternating current electricity.

Modeling and Adaptive Nonlinear Control of Electric Motors - Farshad Khorrami - 2003-05-21
In this book, modeling and control design of electric motors, namely step motors, brushed DC motors and induction motors, as well as the corresponding feedback control design, are addressed. The various types of electric motors, with a slight emphasis on stepper motors. For this purpose, the authors explore modeling of these devices to the extent needed to provide a high-performance controller, but at the same time one amenable to analysis and implementation. The emphasis is on recent robust adaptive nonlinear controllers to attain high performance. It is shown that the adaptive robust nonlinear controller on its own is capable of modeling and output tracking in the presence of motor model uncertainties, and that a carefully tuned classical controllers often achieve required performance in many applications, it is hoped that the adaptive robust nonlinear controllers to attain high performance. It is shown that the adaptive robust nonlinear controller on its own is capable of modeling and output tracking in the presence of motor model uncertainties, and that a carefully tuned classical controllers often achieve required performance in many applications, it is hoped that the adaptive robust adaptive designs will lead to standard universal controllers with minimal need for fine tuning of control parameters.

Nonlinear and Adaptive Control with Applications - Alessandro Astolfi - 2007-12-06
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 inversion. New algorithms are derived for 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 arguments.

Nonlinear Control Systems - Frank Allgower - 2004-12-01
This book provides an introduction to nonlinear control systems at a more elementary level and an exposition of some relevant research findings which have occurred since 1985. On the content, experience gained at the University of Illinois in Urbana-Champaign in 1987, at the Carl-Cranz Gesellschaft in the Federal Republic of Germany in 1988, and at the University of Pisa in 1990. The book is intended for graduate students and researchers in differential geometry.

Neural Network Control of Nonlinear Discrete-Time Systems - Francesco Bullo - 2007-10-06
This book is intended for engineers and researchers interested in using artificial neural networks for control of nonlinear systems. It covers the main theoretical aspects of neural networks and provides tools for designing controllers for nonlinear systems. It is intended for graduate students, researchers, and engineers who are interested in neural network control.

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Hybrid Feedback Control - Ricardo G. Sanfelice - 2021-01-12

A comprehensive introduction to hybrid control systems and design Hybrid control systems exhibit both discrete changes, or jumps, and continuous changes, or flow. An example of a hybrid control system is the automatic control of the temperature in a room: the temperature changes continuously, but the control algorithm toggles the heater on or off intermittently, triggering a discrete jump within the algorithm. Hybrid control systems feature widely across disciplines, including biology, computer science, and engineering, and examples range from the control of cellular responses to self-driving cars. Although classical control theory provides powerful tools for analyzing systems that exhibit either flow or jumps, it is ill-equipped to handle hybrid control systems. In Hybrid Feedback Control, Ricardo Sanfelice presents a self-contained introduction to hybrid control systems and develops new tools for their analysis and design. Hybrid behavior can occur in one or more subsystems of a feedback system, and Sanfelice offers a unified control theory framework, filling an important gap in the control theory literature. In addition to the theoretical framework, he includes a plethora of examples and exercises, a MATLAB toolbox (as well as two open-source versions), and an insightful overview at the beginning of each chapter. Relevant to dynamical systems theory, applied mathematics, and computer science, Hybrid Feedback Control will be useful to students and researchers working on hybrid systems, cyber-physical systems, control, and automation.

Feedback Stabilization of Controlled Dynamical Systems - Nicolas Petit - 2017-03-23

This book is a tribute to Professor Laurent Praly and follows on from a workshop celebrating the occasion of his 60th birthday. It presents new and unified visions of the numerous problems that Laurent Praly has worked on in his prolific career: adaptive control, output feedback and observers, stability and stabilization. His main contributions are the central topic of this book. The book collects contributions written by prominent international experts in the control community, addressing a rich variety of topics: emerging ideas, advanced applications, and theoretical concepts. Organized in three sections, the first section covers the field of adaptive control, where Laurent Praly started his career. The second section focuses on stabilization and output feedback, which is also the topic of the second half of his career. Lastly, the third section presents the emerging research that will form Laurent Praly's scientific legacy.

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