

Preface

About the Subject

Control theory is a multidisciplinary branch of engineering that concerns with the behavior of dynamical systems with inputs (or controls) and seeks to modify the outputs by changes in the inputs using feedback. Linear control theory applies to systems made of linear devices and they obey the superposition principle. For linear control systems, the output of the device is proportional to the input. Nonlinear control theory covers a wider class of systems which do not obey the superposition principle. As most real-world control systems are nonlinear, nonlinear control theory has great applications for real-world control systems. Nonlinear control systems are often governed by nonlinear differential equations and many mathematical techniques have been developed to analyze these systems such as Lyapunov stability theory, limit cycle theory, Poincaré maps, bifurcation theory, chaos theory, and describing functions. In the recent decades, soft computing techniques such as neural networks, fuzzy logic, and evolutionary algorithms have been also successfully applied to analyze and apply nonlinear control theory for many multidisciplinary applications. In the recent decades, advanced techniques such as sliding mode control, fuzzy-based sliding mode control, backstepping control, and adaptive control have been also applied for control systems design. Control systems design has applications in several branches of engineering such as mechanical engineering, aeronautical engineering, electrical engineering, communications engineering, robotics, biomedical instrumentation, etc.

About the Book

The new Springer book, *Advances and Applications in Nonlinear Control Systems*, consists of 30 contributed chapters by subject experts who are specialized in the various topics addressed in this book. The special chapters have been brought out in this book after a rigorous review process in the broad areas of modeling and

applications of nonlinear control systems. Special importance was given to chapters offering practical solutions and novel methods for the recent research problems in the modeling and applications of nonlinear control systems.

This book discusses trends and applications of nonlinear control systems in science and engineering.

Objectives of the Book

This volume presents a selected collection of contributions on a focused treatment of recent advances and applications in nonlinear control systems. The book also discusses multidisciplinary applications in control engineering, computer science, and information technology. These are among those multidisciplinary applications where computational intelligence has excellent potentials for use. Both novice and expert readers should find this book a useful reference in the field of nonlinear control systems.

Organization of the Book

This well-structured book consists of 30 full chapters.

Book Features

- The book chapters deal with the recent research problems in the areas of nonlinear control systems.
- The book chapters contain a good literature survey with a long list of references.
- The book chapters are well written with a good exposition of the research problem, methodology, and block diagrams.
- The book chapters are lucidly illustrated with numerical examples and simulations.
- The book chapters discuss details of engineering applications and future research areas.

Audience

The book is primarily meant for researchers from academia and industry, who are working in the research areas—control engineering, electrical engineering, computer science, and information technology. The book can also be used at the graduate or advanced undergraduate level as a textbook or major reference for courses such as control systems, nonlinear dynamical systems, mathematical modeling, computational science, numerical simulation, and many others.

Acknowledgments

As the editors, we hope that the chapters in this well-structured book will stimulate further research in control systems, computational intelligence, and chaos theory, and utilize them in real-world applications.

We hope sincerely that this book, covering so many different topics, will be very useful for all readers.

We would like to thank all the reviewers for their diligence in reviewing the chapters.

Special thanks go to Springer, especially the book editorial team.

Sundarapandian Vaidyanathan
Christos Volos

Advances and Applications in Nonlinear Control
Systems

Vaidyanathan, S.; Volos, C. (Eds.)

2016, XI, 683 p. 325 illus., 239 illus. in color., Hardcover

ISBN: 978-3-319-30167-9