

Preface

About the Subject

Sliding mode control (SMC) is a nonlinear control method. The sliding mode control method alters the dynamics of a given dynamical system (linear or nonlinear) by applying a discontinuous control signal that forces the system to “slide” along a cross-section (manifold) of the system’s normal behaviour. SMC is a special class of the variable-structure systems (VSS). In sliding mode control method, the state feedback control law is not a continuous function of time. Instead, the state feedback control law can switch from one continuous structure to other structure based on the current position in the state space. For over 50 years, SMC has been extensively studied and widely used in many scientific and industrial applications due to its simplicity and robustness against parameter variations and disturbances. The sliding mode control scheme involves (1) the selecting a hyper-surface or a manifold (i.e. the sliding manifold) such that the system trajectory exhibits desirable behavior when confined to this sliding manifold, and (2) finding feedback gains so that the system trajectory intersects and stays on the sliding manifold. Important types of SMC are classical sliding mode control, integral sliding mode control, higher order sliding mode control, terminal sliding mode control, and super-twisting sliding mode control. The new SMC approaches such as super-twisting sliding mode control show promising dynamical properties such as finite time convergence and chattering alleviation. Sliding mode control has applications in several branches of science and engineering like control systems, chaos theory, mechanical engineering, robotics, electrical engineering, chemical engineering, and network engineering.

About the Book

The new Springer book, *Applications of Sliding Mode Control in Science and Engineering*, consists of 20 contributed chapters by subject experts who are specialized in the various topics addressed in this book. The special chapters have been brought out with a focus on applications of sliding mode control in the broad areas of chaos theory, robotics, electrical engineering, physics, chemical engineering, memristors, mechanical engineering, environmental engineering, finance, and biology. Importance has been given to the chapters offering practical solutions, design and modeling with new types of sliding mode control such as higher order sliding mode control, terminal sliding mode control, super-twisting sliding mode control, and integral sliding mode control.

Objectives of the Book

This volume presents a selected collection of contributions focused on recent advances and applications of sliding mode control in science and engineering. The book focuses on multi-disciplinary applications of SMC in chaos theory, robotics, unmanned aerial vehicles, electrical engineering, physics, chemical engineering, memristors, memristive devices, mechanical engineering, environmental engineering, finance, and biology. These are among those multi-disciplinary applications where computational intelligence has excellent potentials for use. Both novice and expert readers should find this book a useful reference for SMC.

Organization of the Book

This well-structured book consists of 20 full chapters

Book Features

- The book chapters deal with the recent research problems such as applications of SMC.
- The book has contributed chapters by subject experts in sliding mode control.
- 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, block diagrams, 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 using SMC in the research areas—electrical engineering, control engineering, robotics, mechanical engineering, computer science, and information technology. The book can also be used at graduate or advanced undergraduate level as a textbook or a major reference for courses such as power systems, control systems, robotics, electrical devices, scientific modeling, and computational science.

Acknowledgements

As the editors, we hope that the chapters in this well-structured book will stimulate further research using SMC and utilize them in multi-disciplinary applications in both science and engineering.

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.

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Kaohsiung, Taiwan

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