

Preface

About the Subject

Chaos theory deals with the behaviour of dynamical systems and maps that are highly sensitive to initial conditions. Sensitivity to initial conditions is usually called the butterfly effect for dynamical systems and maps. Chaotic systems can be observed in many natural systems such as weather and climate. Chaos theory has applications in several areas such as vibration control, electric circuits, chemical reactions, lasers, combustion engines, computers, cryptosystems, encryption, secure communications, biology, medicine, management, finance, etc. Chaotic behaviour can be studied through the analysis of a chaotic mathematical model (discrete or continuous). This book focuses on research problems such as modelling and analysis of chaotic systems, stabilization and control of chaotic systems, chaos synchronization and applications, chaos in communications and cryptosystems, applications of chaos in engineering, etc. Various tools and methodologies have been developed for the analysis of chaotic systems such as Poincaré maps, Lyapunov exponents, active control, adaptive control, sliding mode control, backstepping control, fuzzy logic control, sampled-data feedback control, and in this book we use the latest control techniques for the study of chaotic systems and control.

Intelligent control describes a class of control techniques that use various artificial intelligence (AI) techniques such as neural network control, fuzzy logic control, neuro-fuzzy control, expert systems, genetic control, evolutionary algorithms, and intelligent agents. Intelligent control systems are useful when no mathematical model is available a priori and intelligent control itself develops a system to be controlled. Intelligent control is inspired by the intelligence and genetics of living beings. This book focuses on various applications of intelligent control on nonlinear control systems, including chaotic systems.

About the Book

The new Springer book, *Advances in Chaos Theory and Intelligent Control*, consists of 36 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 Chaos Theory, Control Systems, Computer Science, Information Technology, modelling and engineering applications. Special importance was given to chapters offering practical solutions and novel methods for the recent research problems in the main areas of this book, viz. Chaos Theory and Intelligent Control.

Objectives of the Book

The objective of this book makes a modest attempt to cover the framework of Chaos Theory and its applications in a single volume. The book is not only a valuable title on the publishing market, it is also a successful synthesis of intelligent control techniques in the world literature. Several multidisciplinary applications in control, engineering and computational intelligence are discussed inside this volume. This book is recommended to engineers of various specialties, mathematicians, information technology specialists and students of those or related specialties. Both novice and expert readers should find this book a useful reference in the field of chaos theory, soft-computing and intelligent control.

Organization of the Book

This well-structured book consists of 36 full chapters. They are organized into two parts.

Part 1: Advances in Chaos Theory

Part 2: Advances in Intelligent Control

Book Features

- The book chapters deal with the recent research problems in the areas of chaos theory, fuzzy systems, evolutionary algorithms, soft computing, intelligent control, modelling and engineering.
- 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—Computer Science, Information Technology, Engineering, Automation, Chaos and Control Engineering. 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, intelligent control, mathematical modeling, computational science, numerical simulation, applied artificial intelligence, fuzzy logic control, and many others.

Acknowledgements

As the editors, we hope that the chapters in this well-structured book will stimulate further research in chaos theory, control systems, soft computing, intelligent control 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.

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