Lyapunov Exponent Vs Parameter Matlab Code

M.A. van Wyk, W.-H. Steeb

Dynamical Systems with Applications using MATLAB® Stephen Lynch,2013-12-01 This introduction to dynamical systems theory guides readers through theory via example and the graphical MATLAB interface; the SIMULINK® accessory is used to simulate real-world dynamical processes. Examples included are from mechanics, electrical circuits, economics, population dynamics, epidemiology, nonlinear optics, materials science and neural networks. The book contains over 330 illustrations, 300 examples, and exercises with solutions.

Essentials of Nonlinear Circuit Dynamics with MATLAB® and Laboratory Experiments Arturo Buscarino, Luigi Fortuna, Mattia Frasca, 2017-04-07 This book deals with nonlinear dynamics of electronic circuits, which could be used in robot control, secure communications, sensors and synchronized networks. The genesis of the content is related to a course on complex adaptive systems that has been held at the University of Catania since 2005. The efforts are devoted in order to emulate with nonlinear electronic circuits nonlinear dynamics. Step-by-step methods show the essential concepts of complex systems by using the Varela diagrams and accompanying MATLAB® exercises to reinforce new information. Special attention has been devoted to chaotic systems and networks of chaotic circuits by exploring the fundamentals, such as synchronization and control. The aim of the book is to give to readers a comprehensive view of the main concepts of nonlinear dynamics to help them better understand complex systems and their control through the use of electronics devices.

Computational And Mathematical Population Dynamics Necibe Tuncer, Maia Martcheva, Olivia Prosper, Lauren Childs, 2023-06-21 This book is a collection of works that represent the recent advancements in computational and mathematical methods applied to population dynamics. It concentrates on both development of new tools as well as on innovative use of existing tools to obtain new understanding of biological systems. The volume introduces new state-of-the-art techniques for defining and solving numerically control problems in mathematical biology in which the control appears linearly. Such problems produce simpler optimal controls that can be implemented in practice. The book further develops tools for fitting multi-scale models to multi-scale data and studying the practical identifiability of the parameters from multi-scale data. Novel model of Zika with Wolbahia infection in mosquitoes suggests that the most suitable control strategy to control Zika in the absence of Wolbahia is killing mosquitoes but the most suitable strategy when mosquitoes are Wolbahia infected is the treatment of humans. A completely novel methodology of developing discrete-continuous hybrid models of

multi-species interactions is also introduced together with avantgarde techniques for discrete-continuous hybrid models analysis. A mathematical model leads to new observations of the within-host virus dynamics and its interplay with the immune responses. In particular, it is observed that the parameters promoting CTL responses need to be boosted over parameters promoting antibody production to obtain a biologically relevant steady state. A novel stochastic model of COVID-19 investigates quarantine and lock down as important strategies for control and elimination of COVID-19.

Analysis and Design of a Lighter-than-Air Vehicle with an Internal Vacuum Anthony Palazotto, 2024-05-01 This book is a compilation of ten technical archival publications describing the analysis of various icosahedrons, primarily of a nonlinear nature. Static and dynamic characteristics are considered, and other covered topics range from large displacements and rotations to the consideration of chaotic behaviour. There is a great deal of experimentation included in several papers, from a quasi-static point of view as well as that of dynamics.

Nonlinear Dynamical Systems with Self-Excited and Hidden Attractors Viet-Thanh Pham, Sundarapandian Vaidyanathan, Christos Volos, Tomasz Kapitaniak, 2018-02-26 This book highlights the latest findings on nonlinear dynamical systems including two types of attractors: self-excited and hidden attractors. Further, it presents both theoretical and practical approaches to investigating nonlinear dynamical systems with self-excited and hidden attractors. The book includes 20 chapters contributed by respected experts, which focus on various applications such as biological systems, memristor-based systems, fractional-order systems, finance systems, business cycles, oscillators, coupled systems, hyperchaotic systems, flexible robot manipulators, electronic circuits, and control models. Special attention is given to modeling, design, circuit realization, and practical applications to address recent research problems in nonlinear dynamical systems. The book provides a valuable reference guide to nonlinear dynamical systems for engineers, researchers, and graduate students, especially those whose work involves mechanics, electrical engineering, and control systems.

Advances in Chaos Theory and Intelligent Control Ahmad Taher Azar, Sundarapandian Vaidyanathan, 2016-04-15 The book reports on the latest advances in and applications of chaos theory and intelligent control. Written by eminent scientists and active researchers and using a clear, matter-of-fact style, it covers advanced theories, methods, and applications in a variety of research areas, and explains key concepts in modeling, analysis, and control of chaotic and hyperchaotic systems. Topics include fractional chaotic systems, chaos control, chaos synchronization, memristors, jerk circuits, chaotic systems with hidden attractors, mechanical and biological chaos, and circuit realization of chaotic systems. The book further covers fuzzy logic controllers, evolutionary algorithms, swarm intelligence, and petri nets among other topics. Not only does it provide the readers with chaos fundamentals and intelligent control-based algorithms; it also discusses key applications of chaos as well as multidisciplinary solutions developed via intelligent control. The book is a timely and comprehensive reference guide for graduate students, researchers, and practitioners in the areas of chaos theory and intelligent control.

Modelling Dynamics in Processes and Systems Wojciech Mitkowski, 2009-06-01 Dynamics is what characterizes virtually all phenomenae we face in the real world, and processes that proceed in practically all kinds of inanimate and animate systems, notably social systems. For our purposes dynamics is viewed as time evolution of some characteristic features of the phenomenae or processes under consideration. It is obvious that in virtually all non-trivial problems dynamics can not be neglected, and should be taken into account in the analyses to, first, get insight into the problem consider, and second, to be able to obtain meaningful results. A convenient tool to deal with dynamics and its related evolution over time is to use the concept of a dynamic system which, for the purposes of this volume can be characterized by the input (control), state and output spaces, and a state transition equation. Then, starting from an initial state, we can find a sequence of consecutive states (outputs) under consecutive inputs (controls). That is, we obtain a trajectory. The state transition equation may be given in various forms, exemplified by differential and difference equations, linear or nonlinear, deterministic or stochastic, or even fuzzy (imprecisely specified), fully or partially known, etc. These features can give rise to various problems the analysts may encounter like numerical difficulties, instability, strange forms of behavior (e.g. chaotic), etc. This volume is concerned with some modern tools and techniques which can be useful for the modeling of dynamics. We focus our attention on two important areas which play a key role nowadays, namely automation and robotics, and biological systems. We also add some new applications which can greatly benefit from the availability of effective and efficient tools for modeling dynamics, exemplified by some applications in security systems.

Reviews in Molecular and Cellular Oncology Daniel P. Bezerra, Kevin Ni, Maoshan Chen, 2023-07-06

Nonlinear Dynamics, Chaos, and Complexity Dimitri Volchenkov,2020-12-14 This book demonstrates how mathematical methods and techniques can be used in synergy and create a new way of looking at complex systems. It becomes clear nowadays that the standard (graph-based) network approach, in which observable events and transportation hubs are represented by nodes and relations between them are represented by edges, fails to describe the important properties of complex systems, capture the dependence between their scales, and anticipate their future developments. Therefore, authors in this book discuss the new generalized theories capable to describe a complex nexus of dependences in multi-level complex systems and to effectively engineer their important functions. The collection of works devoted to the memory of Professor Valentin Afraimovich introduces new concepts, methods, and applications in nonlinear dynamical systems covering physical problems and mathematical modelling relevant to molecular biology, genetics, neurosciences, artificial intelligence as well as classic problems in physics, machine learning, brain and urban dynamics. The book can be read by mathematicians, physicists, complex systems scientists, IT specialists, civil engineers, data scientists, urban planners, and even musicians (with some mathematical background).

The Lyapunov Exponents and Stationarity in ECG Signals Guillermo Vigna Lehmann, 1997

Synchronization in Networks of Nonlinear Circuits Mattia Frasca, Lucia Valentina Gambuzza, Arturo Buscarino, Luigi Fortuna, 2018-03-10 This book addresses synchronization in networks of coupled systems. It illustrates the main aspects of the phenomenon through concise theoretical results and code, allowing readers to reproduce them and encouraging readers to pursue their own experimentation. The book begins by introducing the mathematical representation of nonlinear circuits and the code for their simulation. This is followed by a brief account of the concept of the complex network, which describes the main aspects of complex networks and the main model types, with a particular focus on the code used to study and reproduce the models. The focus then shifts to the process through which independent nonlinear circuits that follow different trajectories without coupling share some properties of their motion: synchronization. The authors present the main techniques for studying synchronization in complex networks, including the major measures, the stability properties and control techniques. The book then moves on to advanced topics in synchronization of complex networks by examining forms of synchronization in which not all the units share the same trajectory, namely chimera states, clustering synchronization, and relay and remote synchronization. Simple codes for experimentation with these topics and control methods are also provided. In closing, the book addresses the problem of synchronization in time-varying networks.

Applied Dynamics Francis C. Moon,2008-10-20 For almost a decade now, this textbook had been at the forefront in using modern analytical and computational codes and in addressing novel developments. Already used by numerous institutions for their courses, this second edition has been substantially revised, with new sections on biomechanics and micro- and nanotechnology. There is also more coverage of robotics, multibody simulations and celestial mechanics. Numerous examples have been added and problems, partly using MATLAB, have been included. * Free solutions manual available for lecturers at www.wiley-vch.de/supplements/

Computational Physics Michael Bestehorn, 2018-04-09 Drawing on examples from various areas of physics, this textbook introduces the reader to computer-based physics using Fortran® and Matlab®. It elucidates a broad palette of topics, including fundamental phenomena in classical and quantum mechanics, hydrodynamics and dynamical systems, as well as effects in field theories and macroscopic pattern formation described by (nonlinear) partial differential equations. A chapter on Monte Carlo methods is devoted to problems typically occurring in statistical physics. Contents Introduction Nonlinear maps Dynamical systems Ordinary differential equations I Ordinary differential equations II Partial differential equations I, basics Partial differential equations II, applications Monte Carlo methods (MC) Matrices and systems of linear equations Program library Solutions of the problems README and a short guide to FE-tools

<u>Chaos in Electronics</u> M.A. van Wyk,W.-H. Steeb,2013-06-29 Many dynamical systems in physics, chemistry and biology exhibit complex be haviour. The apparently random motion of a fluid is the best known example. How ever also vibrating structures, electronic oscillators, magnetic devices, lasers, chemical oscillators, and population kinetics can behave in a

complicated manner. One can find irregular oscillations, which is now known as chaotic behaviour. The research field of nonlinear dynamical systems and especially the study of chaotic systems has been hailed as one of the important breaktroughs in science this century. The sim plest realization of a system with chaotic behaviour is an electronic oscillator. The purpose of this book is to provide a comprehensive introduction to the application of chaos theory to electronic systems. The book provides both the theoretical and experimental foundations of this research field. Each electronic circuit is described in detail together with its mathematical model. Controlling chaos of electronic oscilla tors is also included. End of proofs and examples are indicated by •. Inside examples the end of proofs are indicated with O. We wish to express our gratitude to Catharine Thompson for a critical reading of the manuscript. Any useful suggestions and comments are welcome. Email address of the first author: MVANWYK@TSAMAIL. TRSA. AC. ZA Email address of the first author: WHS@RAU3. RAU. AC. ZA Home page of the authors: http://zeus. rau. ac. za/steeb/steeb. html xi Chapter 1 Introduction 1.

Complex Systems and Their Applications Guillermo Huerta Cuéllar, Eric Campos Cantón, Esteban Tlelo-Cuautle, 2022-06-10 This book is a compilation of scientific articles written by recognized researchers, and select students, participating in the Second Conference on the Study of Complex Systems and their Applications (EDIESCA 2021). EDIESCA 2021 arose from the need for academic and research groups that carry out this scientific research to disseminate their results internationally. The study and characterization of systems with non-linear and/or chaotic behavior has been of great interest to researchers around the world, for which many important results have been obtained with various applications. The dynamic study of chaotic oscillators of different models, such as Rössler, Lorenz, and Chua, has generated important advances in understanding of chemical reactions, meteorological behavior, design of electronic devices, and other applications. Topics at the event included applications for communications systems by masking techniques, financial behavior, networks analysis, nonlinear lasers, numerical modeling, electronic design, and other interesting topics in the area of complex systems. Additionally, there are results on numerical simulation and electronic designs to generate complex dynamic behaviors.

Nonlinear Time Series Analysis Holger Kantz, Thomas Schreiber, 2004 The paradigm of deterministic chaos has influenced thinking in many fields of science. Chaotic systems show rich and surprising mathematical structures. In the applied sciences, deterministic chaos provides a striking explanation for irregular behaviour and anomalies in systems which do not seem to be inherently stochastic. The most direct link between chaos theory and the real world is the analysis of time series from real systems in terms of nonlinear dynamics. Experimental technique and data analysis have seen such dramatic progress that, by now, most fundamental properties of nonlinear dynamical systems have been observed in the laboratory. Great efforts are being made to exploit ideas from chaos theory wherever the data displays more structure than can be captured by traditional methods. Problems of this kind are typical in biology and physiology but also in geophysics,

economics, and many other sciences.

Chaos and Time-series Analysis Julien C. Sprott,2003 This text provides an introduction to the exciting new developments in chaos and related topics in nonlinear dynamics, including the detection and quantification of chaos in experimental data, fractals, and complex systems. Most of the important elementary concepts in nonlinear dynamics are discussed, with emphasis on the physical concepts and useful results rather than mathematical proofs and derivations. While many books on chaos are purely qualitative and many others are highly mathematical, this book fills the middle ground by giving the essential equations, but in the simplestpossible form. It assumes only an elementary knowledge of calculus. Complex numbers, differential equations, and vector calculus are used in places, but those tools are described as required. The book is aimed at the student, scientist, or engineer who wants to learn how to use the ideas in apractical setting. It is written at a level suitable for advanced undergraduate and beginning graduate students in all fields of science and engineering.

Fundamentals of Physics and Chemistry of the Atmosphere Guido Visconti, 2016-06-01 This book is an introductory course to the physics and chemistry of the atmosphere and to climate dynamics. It covers the basics in thermodynamics, fluid dynamics, radiation, and chemistry and explains the most intriguing problems that currently exist in the study of the atmospheres of the Earth and planets. A particular effort is made to approach the different topics intuitively. Among the themes covered are the most recent evolution concerning the chemistry of polluted troposphere, the global warming problem, and chaos and nonlinear theory. The book is almost completely rewritten in comparison to the previous edition, with a more logical organization of the chapters. The fundamentals of thermodynamics, radiation, fluid dynamics and chemistry are introduced in the first six chapters, including a new chapter on remote sensing. Also there is an additional chapter on geoengineering. A significant addition to the new edition, at the end of each chapter, are examples where the topics introduced in the chapter are further discussed with application to classical problems or new research items. Many of these examples are accompanied by computer programs. The most important updates deal with the theory of the general circulation, the methods to evaluate GCM, the detailed discussion of the urban troposphere and the chaos and nonlinear phenomena.

Nonlinear Biomedical Signal Processing, Volume 2 Metin Akay, 2000-09-20 Publisher description: Biomedical / Electrical Engineering Nonlinear Biomedical Signal Processing Volume I: Fuzzy Logic, Neural Networks, and New Algorithms A volume in the IEEE Press Series on Biomedical Engineering Metin Akay, Series Editor For the first time, eleven experts in the fields of signal processing and biomedical engineering have contributed to an edition on the newest theories and applications of fuzzy logic, neural networks, and algorithms in biomedicine. Nonlinear Biomedical Signal Processing, Volume I provides comprehensive coverage of nonlinear signal processing techniques. In the last decade, theoretical developments in the

concept of fuzzy logic have led to several new approaches to neural networks. This compilation delivers plenty of real-world examples for a variety of implementations and applications of nonlinear signal processing technologies to biomedical problems. Included here are discussions that combine the various structures of Kohenen, Hopfield, and multiple-layer designer networks with other approaches to produce hybrid systems. Comparative analysis is made of methods of genetic, back-propagation, Bayesian, and other learning algorithms. Topics covered include: * Uncertainty management * Analysis of biomedical signals * A guided tour of neural networks * Application of algorithms to EEG and heart rate variability signals * Event detection and sample stratification in genomic sequences * Applications of multivariate analysis methods to measure glucose concentration Nonlinear Biomedical Signal Processing, Volume I is a valuable reference tool for medical researchers, medical faculty and advanced graduate student, s as well as for practicing biomedical engineers. Nonlinear Biomedical Signal Processing, Volume I is an excellent companion to Nonlinear Biomedical Signal Processing, Volume II: Dynamic Analysis and Modeling.

<u>Cybersecurity</u> Ahmed A. Abd El-Latif, Christos Volos, 2022-03-25 This book presents techniques and security challenges of chaotic systems and their use in cybersecurity. It presents the state-of-the-art and the latest discoveries in the field of chaotic systems and methods and proposes new models, practical solutions, and technological advances related to new chaotic dynamical systems. The book can be used as part of the bibliography of the following courses: - Cybersecurity - Cryptography - Networks and Communications Security - Nonlinear Circuits - Nonlinear Systems and Applications

Unveiling the Power of Verbal Art: An Psychological Sojourn through Lyapunov Exponent Vs Parameter Matlab Code

In a global inundated with displays and the cacophony of quick communication, the profound power and mental resonance of verbal artistry frequently diminish in to obscurity, eclipsed by the constant assault of noise and distractions. Yet, located within the lyrical pages of **Lyapunov Exponent Vs Parameter Matlab Code**, a fascinating perform of fictional brilliance that impulses with raw emotions, lies an memorable journey waiting to be embarked upon. Penned with a virtuoso wordsmith, that enchanting opus books visitors on an emotional odyssey, softly exposing the latent potential and profound influence stuck within the delicate internet of language. Within the heart-wrenching expanse of the evocative evaluation, we shall embark upon an introspective exploration of the book is central subjects, dissect their interesting publishing design, and immerse ourselves in the indelible effect it leaves upon the depths of readers souls.

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