Dynamical Systems with Applications using MATLAB

By Stephen Lynch, Stephen Lynch, Birkhauser

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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.

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Editorial Review

Review

"This book is an introduction to the theory of discrete and continuous dynamical systems with the aid of the numerical software MATLAB (and Simulink) including its Symbolic Math Toolbox. The intention of the author was to cover a broad field of topics, 'rather than fine detail,' and therefore, 'theorems with proofs have been kept to a minimum' (from the introduction). The text has a definite applied flavor and is driven by a variety of examples from many disciplines like biology (population dynamics, epidemiology), chemistry (reaction kinetics), economics or physics (electric circuits, nonlinear optics).

As a basic principle, these examples are investigated with MATLAB and over 60 programs are listed throughout the book. The source code of these programs can be downloaded from the web as well. No advanced techniques or prerequisites from e.g., functional analysis are needed to understand the book and beyond mathematicians, the text is also readable for applied scientists and engineers." —**Zentralblatt Math**

"The book is a good introduction to dynamical systems theory. ...The theory and applications are presented with the aid of the MATLAB package. Throughout the book, MATLAB is viewed as a tool for solving systems or producing exciting graphics.

...The MATLAB programs are kept as simple as possible and the author's experience has shown that this method of teaching using MATLAB works well with computer laboratory classes of small sizes.

I recommend 'Dynamical Systems with Applications using MATLAB' as a good handbook for a diverse readership: graduates and professionals in mathematics, physics, science and engineering." —**Mathematica**

"The book provides an introduction to the theory of dynamical systems with the aid of MATLAB, Simulink, and Symbolic Math Toolbox. It is written for final-year undergraduates, postgraduate students, and working scientists in both industry and academia. ...Driven by numerous examples from a broad range of disciplines and requiring only knowledge of ordinary differential equations, the text emphasizes applications and simulations using MATLAB.

The first chapter is an efficient tutorial introduction to MATLAB. New users will be able to become familiar with MATLAB within a few hours and those moderately familiar with the package and the experts will find this Chapter 0 a useful source of reference.

...The programs are kept as simple as possible....

The book contains about 330 illustrations, over 330 examples and exercises with solutions that play a key role in the presentation. Over 60 MATLAB program files and Simulink model files are listed throughout the text." —**Revue Roumaine de Mathématiques Pures et Appliquées**

"For the novice the main concepts are stated and examples, which can directly be tested on the computer, help grasp the idea behind these concepts and formalisms. But even the advanced reader will find some interesting examples or a compact introduction to topics he is not so familiar with. Visualization helps to catch on the underlying concepts faster. Watching the solution of a dynamical system evolve in the phase plane, [one] gets a better understanding of the formulas behind [them].… Even the novice is enabled to

handle rather complex problems and manipulate them quickly.… Together with the intuitive approach, the usage of the powerful software packages MATLAB/SIMULINK and the list of references this book provides the reader a good starting point to an intensive examination of dynamical systems. Summing up it can be said that this text allows the reader to have an easy and quick start to the huge field of dynamic systems theory. MATLAB/SIMULINK facilitate this approach under the aspect of learning by doing…" **—OR News/Operations Research Spectrum**

Reviews of the author's Maple® edition:

"…will provide a solid basis for both research and education in nonlinear dynamical systems." **—The Maple® Reporter**

"The text treats a remarkable spectrum of topics…and has a little for everyone. It can serve as an introduction to many of the topics of dynamical systems, and will help even the most jaded reader, such as this reviewer, enjoy some of the interactive aspects of studying dynamics using MAPLE®." **—U.K. Nonlinear News**

"Broad fields of topics are covered and several examples from Mathematics, but also from sciences like Physics (nonlinear optics, electrical circuits), Biology (population dynamics, epidemiology), Chemistry (reaction kinetics) and Economics are detailed. Treating all these problems with MATLAB over 60 programs are included; note also that the source code of these programs can be downloaded from the web. An important aspect, useful for beginners, is that no prerequisites or advanced techniques (e.g. from modern and functional analysis) are needed to understand the contents. Also, a preliminary chapter, namely Chapter 0, is a quick tutorial introduction to MATLAB by examples and problems.

"… The book is very well written and can be used as a basic material for various undergraduate and graduate courses." —Mircea Crâsmareanu, **Analele Stiintifice**

From the Back Cover

This introduction to dynamical systems theory treats both discrete dynamical systems and continuous systems. Driven by numerous examples from a broad range of disciplines and requiring only knowledge of ordinary differential equations, the text emphasizes applications and simulation utilizing MATLAB®, Simulink®, and the Symbolic Math toolbox.

Beginning with a tutorial guide to MATLAB®, the text thereafter is divided into two main areas. In Part I, both real and complex discrete dynamical systems are considered, with examples presented from population dynamics, nonlinear optics, and materials science. Part II includes examples from mechanical systems, chemical kinetics, electric circuits, economics, population dynamics, epidemiology, and neural networks. Common themes such as bifurcation, bistability, chaos, fractals, instability, multistability, periodicity, and quasiperiodicity run through several chapters. Chaos control and multifractal theories are also included along with an example of chaos synchronization. Some material deals with cutting-edge published research articles and provides a useful resource for open problems in nonlinear dynamical systems.

Approximately 330 illustrations, over 300 examples, and exercises with solutions play a key role in the presentation. Over 60 MATLAB® program files and Simulink® model files are listed throughout the text; these files may also be downloaded from the Internet at: http://www.mathworks.com/matlabcentral/fileexchange/. Additional applications and further links of interest are also available at the author's website.

The hands-on approach of *Dynamical Systems with Applications using **MATLAB**®* engages a wide audience of senior undergraduate and graduate students, applied mathematicians, engineers, and working scientists in various areas of the natural sciences.

Reviews of the author's published book *Dynamical Systems with Applications using **Maple**®*:

"The text treats a remarkable spectrum of topics...and has a little for everyone. It can serve as an introduction to many of the topics of dynamical systems, and will help even the most jaded reader, such as this reviewer, enjoy some of the interactive aspects of studying dynamics using Maple®." **–U.K. Nonlinear News**

"...will provide a solid basis for both research and education in nonlinear dynamical systems." **–The Maple Reporter**

About the Author
Stephen Lynch is Senior Lecturer in the Department of Computing and Mathematics at Manchester Metropolitan University.

Users Review

From reader reviews:

Susan Swain:

This Dynamical Systems with Applications using MATLAB tend to be reliable for you who want to be a successful person, why. The reason why of this Dynamical Systems with Applications using MATLAB can be one of several great books you must have is definitely giving you more than just simple studying food but feed a person with information that might be will shock your prior knowledge. This book is actually handy, you can bring it everywhere you go and whenever your conditions in the e-book and printed ones. Beside that this Dynamical Systems with Applications using MATLAB forcing you to have an enormous of experience like rich vocabulary, giving you trial run of critical thinking that we realize it useful in your day action. So , let's have it and revel in reading.

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