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Modeling And Analysis Of Dynamic Systems

**This new
interdisciplinary
work presents
system dynamics as
a powerful approach**

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**to enable analysts
build simulation
models of social
systems, with a view
toward enhancing
decision making.
Grounded in the
feedback
perspective of
complex systems,
the book provides a
practical
introduction to
system dynamics,**

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and covers key concepts such as stocks, flows, and feedback. Societal challenges such as predicting the impact of an emerging infectious disease, estimating population growth, and assessing the capacity of health services to cope with demographic

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**change can all
benefit from the
application of
computer
simulation. This text
explains important
building blocks of
the system
dynamics approach,
including material
delays, stock
management
heuristics, and how
to model effects**

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**between different
systemic elements.**

**Models from
epidemiology,
health systems, and
economics are
presented to
illuminate important
ideas, and the R
programming
language is used to
provide an open-
source and
interoperable way to**

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build system
dynamics models.

**System Dynamics
Modeling with R
also describes
hands-on
techniques that can
enhance client
confidence in
system dynamic
models, including
model testing,
model analysis, and
calibration.**

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Developed from the author's course in system dynamics, this book is written for undergraduate and postgraduate students of management, operations research, computer science, and applied mathematics. Its focus is on the fundamental

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building blocks of system dynamics models, and its choice of R as a modeling language make it an ideal reference text for those wishing to integrate system dynamics modeling with related data analytic methods and techniques. Offers timely and

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**comprehensive
coverage of
dynamic system
reliability theory
This book focuses
on hot issues of
dynamic system
reliability,
systematically
introducing the
reliability modeling
and analysis
methods for
systems with**

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**imperfect fault
coverage, systems
with function
dependence,
systems subject to
deterministic or
probabilistic
common-cause
failures, systems
subject to
deterministic or
probabilistic
competing failures,
and dynamic**

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**standby sparing
systems. It presents**

**recent
developments of
such extensions
involving reliability
modelling theory,
reliability evaluation
methods, and
features numerous
case studies based
on real-world
examples. The
presented dynamic**

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reliability theory can enable a more accurate representation of actual complex system behavior, thus more effectively guiding the reliable design of real-world critical systems. Dynamic System Reliability: Modelling and Analysis of Dynamic

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and Dependent Behaviors begins by describing the evolution from the traditional static reliability theory to the dynamic system reliability theory, and provides a detailed investigation of dynamic and dependent behaviors in

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subsequent chapters. Although written for those with a background in basic probability theory and stochastic processes, the book includes a chapter reviewing the fundamentals that readers need to know in order to understand contents

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**of other chapters
which cover
advanced topics in
reliability theory and
case studies. The
first book
systematically
focusing on
dynamic system
reliability modelling
and analysis theory
Provides a
comprehensive
treatment on**

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imperfect fault coverage (single-level/multi-level or modular), function dependence, common cause failures (deterministic and probabilistic), competing failures (deterministic and probabilistic), and dynamic standby sparing Includes

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**abundant illustrative
examples and case
studies based on
real-world systems
Covers recent
advances in
combinatorial
models and
algorithms for
dynamic system
reliability analysis
Offers a rich set of
references,
providing helpful**

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**resources for
readers to pursue
further research and
study of the topics
Dynamic System
Reliability:
Modelling and
Analysis of Dynamic
and Dependent
Behaviors is an
excellent book for
undergraduate and
graduate students,
and engineers and**

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**researchers in
reliability and
related disciplines.
A primer on
modeling concepts
and applications
that is specifically
geared toward the
environmental field.
Sections on
modeling
terminology, the
uses of models, the
model-building**

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process, and the interpretation of output provide the foundation for detailed applications. After an introduction to the basics of dynamic modeling, the book leads students through an analysis of several environmental problems, including

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**surface-water
pollution, matter-
cycling disruptions,
and global warming.
The scientific and
technical context is
provided for each
problem, and the
methods for
analyzing and
designing
appropriate
modeling
approaches is**

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provided. While the mathematical content does not exceed the level of a first-semester calculus course, the book gives students all of the background, examples, and practice exercises needed both to use and understand environmental

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modeling. It is suitable for upper-level undergraduate and beginning-graduate level environmental professionals seeking an introduction to modeling in their field.

Collecting the work of the foremost scientists in the

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**field, Discrete-Event
Modeling and
Simulation: Theory
and Applications
presents the state of
the art in modeling
discrete-event
systems using the
discrete-event
system specification
(DEVS) approach. It
introduces the latest
advances, recent
extensions of formal**

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techniques, and real-world examples of various applications. The book covers many topics that pertain to several layers of the modeling and simulation architecture. It discusses DEVS model development support and the interaction of DEVS

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with other methodologies. It describes different forms of simulation supported by DEVS, the use of real-time DEVS simulation, the relationship between DEVS and graph transformation, the influence of DEVS variants on simulation

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performance, and interoperability and composability with emphasis on DEVS standardization. The text also examines extensions to DEVS, new formalisms, and abstractions of DEVS models as well as the theory and analysis behind real-world system identification and

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control. To support the generation and search of optimal models of a system, a framework is developed based on the system entity structure and its transformation to DEVS simulation models. In addition, the book explores numerous interesting

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examples that illustrate the use of DEVS to build successful applications, including optical network-on-chip, construction/building design, process control, workflow systems, and environmental models. A one-stop resource on

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**advances in DEVS
theory, applications,
and methodology,
this volume offers a
sampling of the best
research in the area,
a broad picture of
the DEVS
landscape, and
trend-setting
applications enabled
by the DEVS
approach. It
provides the basis**

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**for future research
discoveries and
encourages the
development of new
applications.**

**Modeling Data with
Differential
Equations**

**Analytical Methods
for Dynamic
Modelers**

**Dynamic Modeling
and Applications for
Global Economic**

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**Analysis
Dynamic Social
Network Modeling
and Analysis
Discrete-Event
Modeling and
Simulation
The dynamic
development of
various
processes is a
central
problem of**

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**biology and
indeed of all
the sciences.**

**The
mathematics
describing
that
development
is, in
general,
complicated,
because the**

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**models that
are realistic
are usually
nonlinear.
Consequently
many
biologists may
not notice a
possible
application of
theory. They
may be unable**

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**to decide
whether a
particular
model captures
the essence of
a system, or
to appreciate
that analysis
of a model can
reveal
important
aspects of**

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**biological
problems and
may even
describe in
detail how a
system works.
The aim of
this textbook
is to remedy
the situation
by adopting a
general**

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**approach to
model analysis
and applying
it several
times to
problems
(drawn
primarily from
molecular and
cellular
biology) of
gradually**

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**increasing
biological and
mathematical
complexity.**

**Although
material of
considerable
sophistication
is included,
little
mathematical
background is**

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**required -
only some
exposure to
elementary
calculus;
appendixes
supply the
necessary
mathematics
and the author
concentrates
on concepts**

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rather than techniques. He also emphasizes the role of computers in giving a full picture of model behavior and complementing more

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**qualitative
analysis. Some
problems
suitable for
computer
analysis are
also included.
This is a
class-tested
textbook
suitable for a
one-semester**

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advanced
undergraduate
and beginning
graduate
students in
biology or
applied
mathematics.
It can also be
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and a
reference for
specialists.
The book
presents the
methodology
applicable to
the modeling
and analysis
of a variety
of dynamic**

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**systems,
regardless of
their physical
origin. It
includes
detailed
modeling of
mechanical,
electrical, el
ectro-
mechanical,
thermal, and**

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**fluid systems.
Models are
developed in
the form of
state-variable
equations,
input-output
differential
equations,
transfer
functions, and
block**

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**diagrams. The
Laplace-
transform is
used for
analytical
solutions.
Computer
solutions are
based on
MATLAB and
Simulink.
This text is**

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**intended for a
first course
in dynamic
systems and is
designed for
use by
sophomore and
junior majors
in all fields
of
engineering,
but**

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**principally
mechanical and
electrical
engineers. All
engineers must
understand how
dynamic
systems work
and what
responses can
be expected
from various**

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**physical
systems.**

**Introduction
to MATLAB,
Simulink, and
Simscape --
Complex
analysis,
differential
equations and
Laplace
transformation**

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-- Matrix
analysis --
System model
representation
-- Mechanical
systems --
Electrical,
electronic,
and electromec
hanical
systems --
Fluid and

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**thermal
systems --
System
response --
Introduction
to vibrations
--
Introduction
to feedback
control
systems
Bayesian**

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**Forecasting
and Dynamic
Models**

**Modeling and
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Dynamic
Systems
Dynamic
Systems**

**Multi-body
Dynamic
Modeling of**

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**Multi-Legged
Robots**

**Data-Driven
Modeling of
Complex
Systems**

Modeling and
Analysis of
Dynamic
Systems, Third
Edition
introduces

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MATLAB[®],
Simulink[®], and
Simscape[™] and
then utilizes
them to perform
symbolic,
graphical,
numerical, and
simulation
tasks. Written
for senior
level courses/m
odules, the

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covers
techniques for
modeling a
variety of
engineering
systems,
methods of
response
analysis, and
introductions
to mechanical

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vibration, and
to basic
control
systems. These
features
combine to
provide
students with a
thorough
knowledge of
the
mathematical
modeling and

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analysis of
dynamic
systems. The
Third Edition
now includes
Case Studies,
expanded
coverage of
system
identification,
and updates to
the
computational

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tools included.

The development and use of models of various objects is becoming a more common practice in recent days.

This is due to the ease with which models can be

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developed and examined through the use of computers and appropriate software. Of those two, the former - high-speed computers - are easily accessible nowadays, and the latter -

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existing programs - are being updated almost continuously, and at the same time new powerful software is being developed. Usually a model represents

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correlations between some processes and their interactions, with better or worse quality of representation. It details and characterizes a part of the real world

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taking into account a structure of phenomena, as well as quantitative and qualitative relations.

There are a great variety of models.

Modelling is carried out in

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many diverse fields. All types of natural phenomena in the area of biology, ecology and medicine are possible subjects for modelling.

Models stand

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for and
represent
technical
objects in
physics,
chemistry,
engineering,
social events
and behaviours
in sociology,
financial
matters,
investments and

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stock markets
in economy,
strategy and
tactics,
defence,
security and
safety in
military
fields. There
is one common
point for all
models. We
expect them to

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fulfil the
validity of
prediction. It
means that
through the
analysis of
models it is
possible to
predict
phenomena,
which may occur
in a fragment
of the real

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world
represented by
a given model.

We also expect
to be able to
predict future
reactions to
signals from
the outside
world.

The use of
dynamic models
in the

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development of information systems is regarded by many researchers as a promising issue in design support.

Modelling the dynamics of information systems is

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likely to improve the quality and the performance of the design products.

Dynamic modelling as a new approach for dynamic analysis of problems within an existing

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situation, and design and evaluation of different solution strategies may overcome many difficulties in the design process. Continuous-system simulation is

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an increasingly important tool for optimizing the performance of real-world systems. The book presents an integrated treatment of continuous simulation with all the background and

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essential prerequisites in one setting. It features updated chapters and two new sections on Black Swan and the Stochastic Information Packet (SIP) and Stochastic

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with Dynamic Systems

Relationships
Preserved
(SLURP)
Standard. The
new edition
includes basic
concepts,
mathematical
tools, and the
common
principles of

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various
simulation
models for
different
phenomena, as
well as an
abundance of
case studies,
real-world
examples,
homework
problems, and
equations to

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develop a
practical
understanding
of concepts.
Handbook of
Dynamic System
Modeling
For Control
Engineers
Measurements,
Modelling and
Simulation of
Dynamic Systems

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Modeling,
Analysis, and
Control of
Dynamic Systems
Modeling and
Analysis

In this book we are concerned with Bayesian learning and forecasting in dynamic environments. We

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describe the structure and theory of classes of dynamic models, and their uses in Bayesian forecasting. The principles, models and methods of Bayesian forecasting have been developed

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extensively during the last twenty years. This development has involved thorough investigation of mathematical and statistical aspects of forecasting models and related

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techniques. With this has come experience with application in a variety of areas in commercial and industrial, scientific and socio-economic fields. In deed much of the technical development has been driven by

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the needs of forecasting practitioners. As a result, there now exists a relatively complete statistical and mathematical framework, although much of this is either not properly documented or

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not easily
accessible. Our
primary goals in
writing this
book have been
to present our
view of this
approach to
modelling and
forecasting, and
to provide a rea-
sonably complete
text for
advanced

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university
students and
research
workers. The
text is
primarily
intended for
advanced
undergraduate
and postgraduate
students in
statistics and
mathematics. In
line with this

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*objective we
present thorough
discussion of
mathematical and
statistical
features of
Bayesian
analyses of
dynamic models,
with
illustrations,
examples and
exercises in
each Chapter.*

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This text focuses on the use of smoothing methods for developing and estimating differential equations following recent developments in functional data analysis and building on techniques

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*described in
Ramsay and
Silverman (2005)
Functional Data
Analysis. The
central concept
of a dynamical
system as a
buffer that
translates
sudden changes
in input into
smooth
controlled*

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*output responses
has led to
applications of
previously
analyzed data,
opening up
entirely new
opportunities
for dynamical
systems. The
technical level
has been kept
low so that
those with*

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little or no exposure to differential equations as modeling objects can be brought into this data analysis landscape. There are already many texts on the mathematical properties of ordinary

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differential equations, or dynamic models, and there is a large literature distributed over many fields on models for real world processes consisting of differential equations.

However, a researcher

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*interested in
fitting such a
model to data,
or a
statistician
interested in
the properties
of differential
equations
estimated from
data will find
rather less to
work with. This
book fills that*

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gap.

This second edition of Working with Dynamic Crop Models is meant for self-learning by researchers or for use in graduate level courses devoted to methods for working with

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*dynamic models
in crop,
agricultural,
and related
sciences. Each
chapter focuses
on a particular
topic and
includes an
introduction, a
detailed
explanation of
the available
methods,*

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*applications of
the methods to
one or two
simple models
that are
followed
throughout the
book, real-life
examples of the
methods from
literature, and
finally a
section
detailing*

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*implementation
of the methods
using the R
programming
language. The
consistent use
of R makes this
book immediately
and directly
applicable to
scientists
seeking to
develop models
quickly and*

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*effectively, and
the selected
examples ensure
broad appeal to
scientists in
various
disciplines. New
to this edition:
50% new content
- 100% reviewed
and updated
Clearly explains
practical
application of*

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*the methods
presented,
including R
language
examples
Presents real-
life examples of
core crop
modeling
methods, and
ones that are
translatable to
dynamic system
models in other*

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A user-friendly
introduction to
some of the most
useful
analytical tools
for model
building,
estimation, and
analysis,
presenting key
methods and
examples.

Simulation

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modeling is increasingly integrated into research and policy analysis of complex sociotechnical systems in a variety of domains. Model-based analysis and policy design inform a range of

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*applications in
fields from
economics to
engineering to
health care.
This book offers
a hands-on
introduction to
key analytical
methods for
dynamic
modeling.
Bringing
together tools*

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and methodologies from fields as diverse as computational statistics, econometrics, and operations research in a single text, the book can be used for graduate-level courses and as a

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*reference for
dynamic modelers
who want to
expand their
methodological
toolbox. The
focus is on
quantitative
techniques for
use by dynamic
modelers during
model
construction and
analysis, and*

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the material presented is accessible to readers with a background in college-level calculus and statistics. Each chapter describes a key method, presenting an introduction that emphasizes

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the basic intuition behind each method, tutorial style examples, references to key literature, and exercises. The chapter authors are all experts in the tools and methods they present. The

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*book covers
estimation of
model parameters
using
quantitative
data;
understanding
the links
between model
structure and
its behavior;
and decision
support and
optimization. An*

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*online appendix
offers computer
code for
applications,
models, and
solutions to
exercises.*

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*Theory and
Applications
Dynamic System
Modeling and
Analysis with
MATLAB and
Python*

*Dynamic Models
in Biology*

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Process Dynamics

The purpose of this monograph is threefold. First, mathematical models of the transient behavior of some or all of the state variables describing the

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motion of multiple-
link flexible

structures will be
developed. The
structures which
we have in mind
consist of finitely
many

interconnected
flexible elements
such as strings,
beams, plates and

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shells or combinations thereof and are representative of trusses, frames, robot arms, solar panels, antennae, deformable mirrors, etc. , currently in use. For example, a typical subsystem

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found in almost all aircraft and space vehicles consists of beam, plate and/or shell elements attached to each other in a rigid or flexible manner. Due to limitations on their weights, the elements

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themselves must be highly flexible, and due to limitations on their initial configuration (i. e. , before deployment), those aggregates often have to contain several links so that the substructure may

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be unfolded or telescoped once it is deployed. The point of view we wish to adopt is that in order to understand completely the dynamic response of a complex elastic structure it is not sufficient to

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con to take into
account the sider
only its global
motion but also
necessary
flexibility of
individual elements
and the interaction
and transmission
of elastic effects
such as bending,
torsion and axial

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deformations at junctions where members are connected to each other. The second object of this book is to provide rigorous mathematical analyses of the resulting models.

The topic of

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dynamic models tends to be splintered across various disciplines, making it difficult to uniformly study the subject. Moreover, the models have a variety of representations, from traditional mathematical

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notations to
diagrammatic and
immersive
depictions.

Collecting all of
these expressions
of dynamic
models, the
Handbook of
Dynamic System
Modeling explores
a panoply of

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different types of modeling methods available for dynamical systems. Featuring an interdisciplinary, balanced approach, the handbook focuses on both generalized

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dynamic
knowledge and
specific models. It
first introduces the
general concepts,
representations,
and philosophy of
dynamic models,
followed by a
section on
modeling
methodologies that

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explains how to portray designed models on a computer. After addressing scale, heterogeneity, and composition issues, the book covers specific model types that are often characterized by

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specific visual- or text-based grammars. It concludes with case studies that employ two well-known commercial packages to construct, simulate, and analyze dynamic models. A

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