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analysis of all the major types of

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system models. Throughout the text, there are many examples and applications to important classes of systems in areas such as power and energy, feedback control, artificial neural networks, digital signal processing and control, manufacturing, computer networks,

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and socio-economics. Replete with exercises and requiring basic knowledge of linear algebra, analysis, and differential equations, the work may be used as a textbook for graduate courses in stability theory of dynamical systems. The book may also serve as a self-study reference for

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systems. Karl Åström and Richard Murray use techniques from physics, computer science, and operations research to introduce control-oriented modeling. They begin with state space tools for analysis and design, including stability of solutions, Lyapunov functions,

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reachability, state feedback  
observability, and estimators. The  
matrix exponential plays a central  
role in the analysis of linear control  
systems, allowing a concise  
development of many of the key  
concepts for this class of models.

Åström and Murray then develop and

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explain tools in the frequency domain, including transfer functions, Nyquist analysis, PID control, frequency domain design, and robustness. Features a new chapter on design principles and tools, illustrating the types of problems that can be solved using feedback

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fundamental limits and new material  
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Researchers seeking a self-contained  
resource on control theory

Modeling and analyzing the dynamics  
of chemical mixtures by means of  
differ- tial equations is one of the  
prime concerns of chemical  
engineering theorists. These

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equations often take the form of systems of nonlinear parabolic partial differential equations, or reaction-diffusion equations, when there is diffusion of chemical substances involved. A good overview of this endeavor can be had by reading the two volumes by R. Aris (1975), who

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himself was one of the main contributors to the theory.

Enthusiasm for the models developed has been shared by parts of the mathematical community, and these models have, in fact, provided motivation for some beautiful mathematical results. There are

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analogies between chemical reactors and certain biological systems. One such analogy is rather obvious: a single living organism is a dynamic structure built of molecules and ions, many of which react and diffuse. Other analogies are less obvious; for example, the electric potential of a



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membrane can diffuse like a chemical, and of course can interact with real chemical species (ions) which are transported through the membrane. These facts gave rise to Hodgkin's and Huxley's celebrated model for the propagation of nerve signals. On the level of populations,

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individuals interact and move about, and so it is not surprising that here, again, the simplest continuous space-time interaction-migration models have the same general appearance as those for diffusing and reacting chemical systems.

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This book is about dynamical systems that are "hybrid" in the sense that they contain both continuous and discrete state variables. Recently there has been increased research interest in the study of the interaction between discrete and continuous dynamics. The present volume

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Provides a first attempt in book form to bring together concepts and methods dealing with hybrid systems from various areas, and to look at these from a unified perspective. The authors have chosen a mode of exposition that is largely based on illustrative examples rather than on

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the abstract theorem-proof format because the systematic study of hybrid systems is still in its infancy. The examples are taken from many different application areas, ranging from power converters to communication protocols and from chaos to mathematical finance.

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Subjects covered include the following: definition of hybrid systems; description formats; existence and uniqueness of solutions; special subclasses (variable-structure systems, complementarity systems); reachability and verification; stability and

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stabilizability; control design  
methods. The book will be of interest  
to scientists from a wide range of  
disciplines including: computer  
science, control theory, dynamical  
system theory, systems modeling and  
simulation, and operations research.

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"Hybrid systems are networks of interacting digital and analog devices. Control systems for

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inherently unstable aircraft and computer aided manufacturing are typical applications for hybrid systems, but due to the rapid development of processor and circuit technology modern cars and consumer electronics use software to control physical processes. The



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Identifying characteristic of hybrid systems is that they incorporate both continuous components governed by differential equations and also digital components - digital computers, sensors, and actuators controlled by programs. This volume of invited refereed papers is inspired by a

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workshop on the Theory of Hybrid  
Systems, held at the Technical  
University, Lyngby, Denmark, in  
October 1992, and by a prior Hybrid  
Systems Workshop, held at Cornell  
University, USA, in June 1991,  
organized by R.L. Grossman and A.  
Nerode. Some papers are the final

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versions of papers presented at these workshops and some are invited papers from other researchers who were not able to attend these workshops."--PUBLISHER'S WEBSITE.

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Setting out core theory and reviewing a range of new methods, theoretical

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And Robust Synthesis, this handbook shows how hybrid dynamical systems can be modelled and understood. Sixty expert authors involved in the recent research activities and industrial application studies provide practical insights on topics ranging from the theoretical

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Investigations over computer-aided design to applications in energy management and the process industry. Structured into three parts, the book opens with a thorough introduction to hybrid systems theory, illustrating new dynamical phenomena through numerous

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examples. Part II then provides a survey of key tools and tool integration activities. Finally, Part III is dedicated to applications, implementation issues and system integration, considering different domains such as industrial control, automotive systems and digital

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networks. Three running examples are referred to throughout the book, together with numerous illustrations, helping both researchers and industry professionals to understand complex theory, recognise problems and find appropriate solutions.

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The theory of switched systems is related to the study of hybrid systems, which has gained attention from control theorists, computer scientists, and practicing engineers. This book examines switched systems from a control-theoretic perspective, focusing on stability analysis and



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control synthesis of systems that combine continuous dynamics with switching events. It includes a vast bibliography and a section of technical and historical notes.

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