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Hybrid Systems II



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Preface

Hybrid Systems are models for networks of digital and continuous devices, in which digital control programs sense and supervise continuous and discrete plants governed by differential or difference equations. Modern industrial society is filled with hybrid systems used for such varied purposes as aircraft control, computer synchronization, manufacturing, communication networks, traffic control, industrial process control, etc. Hybrid systems also provide the basic framework and methodology for the synthesis and analysis of autonomous and intelligent systems. Examples in this area include medical informatics systems, highway control and routing systems, robotics, and database management and retrieval systems.

In addition, hybrid systems theory provides the backbone for the formulation and implementation of learning control policies. In such policies, the control acquires knowledge (discrete data) to improve the behavior of the system as it evolves in time.

Hybrid Systems has become a distinctive area of study due to opportunities to improve on traditional control and estimation technologies by providing computationally effective methodologies for the implementation of digital programs that design or modify the control law in response to sensor detected events, or as a result of learning.

The areas of science and engineering that can be brought to bear on the issue of hybrid control are numerous. These include mathematical disciplines such as functional analysis, variational calculus, ordinary differential equations, linear partial differential equations, Lie algebras, differential geometry, dynamical systems; operations research disciplines such as linear and integer and non-smooth mathematical programming; engineering disciplines such as linear and optimal and intelligent control, stochastic processes, stochastic approximation, discrete event simulation; computer science disciplines such as distributed and agent-based systems, automata theory, and program validation and verification; and branches of mathematical logic and applied logic such as logic programming. We are gradually gaining an understanding of the subtle interplay of mathematical and physical disciplines involved in hybrid systems. The investigation of hybrid systems is creating a new and fascinating discipline bridging mathematics, control engineering, and computer science.

The first workshop on Hybrid Systems was held at the Mathematical Sciences Institute (MSI) of Cornell University June 10-12, 1991. The second workshop was held at the Technical University in Lyngby, Denmark, October 19-21, 1992 and inspired the volume *Hybrid Systems* (Springer Lecture Notes in Computer Science 736, Grossman, Nerode, Rischel, Ravn, eds., 1993). The third workshop was held at MSI on October 28-30, 1994 and resulted in this volume, which consists of fully refereed papers.

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June 1995

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Table of Contents

Symbolic Controller Synthesis for Discrete and Tined Systems	1
<i>E. Asarin, O. Maler and A. Pnueli</i>	
A Calculus of Stochastic Systems for the Specification , Simulation, and Hidden State Estimation of Hybrid Stochastic/Non-stochastic Systems	21
<i>A. Benveniste, B.C. Levy, E. Fabre and P. Le Guernic</i>	
Condensation of Information from Signals for Process Modeling and Control	45
<i>J.D. Birdwell and B.C. Moore</i>	
On the Automatic Verification of Systems with Continuous Variables and Unbounded Discrete Data Structures	64
<i>A. Bouajjani, R. Echahed and R. Robbana</i>	
On Dynamically Consistent Hybrid Systems	86
<i>P.E. Caines and Y.-J. Wei</i>	
A Self-learning Neuro-Fuzzy System	106
<i>N. DeClaris and M.-C. Su</i>	
Viable Control of Hybrid Systems	128
<i>A. Deshpande and P. Varaiya</i>	
Modeling and Stability Issues in Hybrid Systems	148
<i>M. Doğruel and U. Özgüner</i>	
Hierarchical Hybrid Control: a Case Study	166
<i>D.N. Godbole, J. Lygeros and S. Sastry</i>	
Hybrid Systems and Quantum Automata: Preliminary Announcement ...	191
<i>R.L. Grossman and M. Sweedler</i>	
Planar Hybrid Systems	202
<i>J. Guckenheimer and S. Johnson</i>	
Programming in Hybrid Constraint Languages	226
<i>V. Gupta, R. Jagadeesan, V. Saraswat and D.G. Bobrow</i>	
A Note on Abstract Interpretation Strategies for Hybrid Automata	252
<i>T. A. Henzinger and P.-H. Ho</i>	
HYTECH: The Cornell HYbrid TECHnology Tool	265
<i>T. A. Henzinger and P.-H. Ho</i>	
Hybrid Systems as Finsler Manifolds: Finite State Control as Approximation to Connections	294
<i>W. Kohn, A. Nerode and J.B Rummel</i>	
Constructing Hybrid Control Systems from Robust Linear Control Agents	322
<i>M. Lemmon, C. Bett, P. Szymanski and P. Antsaklis</i>	
Controllers as Fixed Points of Set-Valued Operators	344
<i>A. Nerode, J.B. Rummel and A. Yakhnis</i>	

Verification of Hybrid Systems Using Abstractions	359
<i>A. Puri and P. Varaiya</i>	
Control of Continuous Plants by Symbolic Output Feedback	370
<i>J. Raisch</i>	
Hybrid Control of a Robot - a Case Study	391
<i>A. P. Ravn, H. Rischel, M. Holdgaard, T.J. Eriksen, F. Conrad</i> <i>and T. O Andersen</i>	
Verifying Time-bounded Properties for ELECTRE Reactive Programs with Stopwatch Automata	405
<i>O. Roux, V. Rusu</i>	
Inductive Modeling: A Framework Marrying Systems Theory and Non-monotonic Reasoning	417
<i>H.S. Sarjoughian and B. Zeigler</i>	
Semantics and Verification of Hierarchical CRP Programs	436
<i>R.K. Shyamasundar and S. Ramesh</i>	
Interface and Controller Design for Hybrid Control Systems	462
<i>J.A. Stiver, P. J. Antsaklis and M.D. Lemmon</i>	
Hybrid Objects	493
<i>M. Tittus and B. Egardt</i>	
Modeling of Hybrid Systems Based on Extended Coloured Petri Nets	509
<i>Y.Y. Yang, D.A. Linkens and S.P. Banks</i>	
DEVS Framework for Modeling, Simulation, Analysis, and Design of Hybrid Systems	529
<i>B.P. Zeigler, H.S. Song, T.G Kim, H. Praehofer</i>	
Synthesis of Hybrid Constraint-Based Controllers	552
<i>Y. Zhang and A.K. Mackworth</i>	
Author Index	569