

# **2nd IFAC Conference on Analysis and Design of Hybrid Systems 2006**

**Alghero, Italy  
7-9 June 2006**

**Editors:**

**C.G. Cassandras  
C. Seatzu**

**A. Giua  
J. Zaytoon**

**ISBN: 978-1-61839-617-4**

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2006) by Elsevier Limited  
All rights reserved.

Printed by Curran Associates, Inc. (2012)

For permission requests, please contact the publisher, Elsevier Limited  
at the address below.

Elsevier Limited  
The Boulevard, Langford Lane  
Kidlington OX5 1GB, United Kingdom

Phone: +44 (0)1865 844640  
Fax: +44 (0)1865 843912

Email: eurobkinfo@elsevier.com

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2634  
Email: curran@proceedings.com  
Web: www.proceedings.com

# Table of Contents

---

## *ADHS'06*

*2nd IFAC Conference on Analysis and Design of Hybrid Systems  
Alghero, Italy – June 7-9, 2006*

---

### **Plenary Lectures**

Chattering Problem for Sliding Mode Control Systems <i>V. Utkin, H. Lee</i>	1
Challenges and opportunities for system theory in embedded controller design <i>A. Sangiovanni Vincentelli</i>	2
Optimal Control in Hybrid Systems <i>C. Iung, P. Riedinger</i>	4

### **WA1 – Observers for Hybrid Systems**

Convergent design of switched linear systems <i>R.A. van den Berg, A.Y. Pogromsky, J.E. Rooda</i>	6
Observer design for a class of discrete time piecewise-linear systems <i>A. Birouche, J. Daafouz, C. Iung</i>	12
Designing switched observers for switched systems using multiple Lyapunov functions and dwell-time switching <i>S. Pettersson</i>	18
Critical states detection with bounded probability of false alarm and application to air traffic management <i>M.D. Di Benedetto, S. Di Gennaro, A. D'Innocenzo</i>	24

### **WA2 - Continuous and Hybrid Petri Nets**

Tracking control of join-free timed continuous Petri net systems <i>J. Xu, L. Recalde, M. Silva</i>	30
On sampling continuous timed Petri nets: reachability "equivalence" under infinite servers semantics <i>C. Mahulea, A. Giua, L. Recalde, C. Seatzu, M. Silva</i>	37
Modelling distributed manufacturing systems via first order hybrid Petri nets <i>M. Dotoli, M.P. Fanti, A.M. Mangini</i>	44
Simulation of railway stations based on hybrid Petri nets <i>F. Kaakai, S. Hayat, A. El-Moudni</i>	50

### **WB1 – Modeling and Simulation of Hybrid Systems**

Modeling an impact control strategy using HyPA <i>P.J.L. Cuijpers, M.A. Reniers</i>	56
Human skill modeling based on stochastic switched dynamics <i>T. Suzuki, S. Inagaki, N. Yamada</i>	64
Building efficient simulations from hybrid bond graph models <i>C.D. Beers, E.-J. Manders, G. Biswas, P.-J. Mosterman</i>	71
Robust control strategies for multi-inventory systems with average flow constraints <i>D. Bauso, F. Blanchini, R. Pesenti</i>	77

**WB2 - Control of Hybrid Systems 1**

Hybrid constrained formation flying control of micro-satellites <i>F. Bacconi, A. Casavola, E. Mosca</i>	83
A gradient-based approach to a class of hybrid optimal control problems <i>V. Azhmyakov, J. Raisch</i>	89
Optimal mode-switching for hybrid systems with unknown initial state <i>H. Axelsson, M. Boccadoro, Y. Wardi, M. Egerstedt</i>	95
Beyond the construction of optimal switching surfaces for autonomous hybrid systems <i>M. Boccadoro, M. Egerstedt, P. Valigi, Y. Wardi</i>	101

**WC1 - Structural Analysis and Approximation of Hybrid Systems (Invited)**Organizer: *E. De Santis*

Approximate simulation relations for hybrid systems <i>A. Girard, A.A. Julius, G.J. Pappas</i>	106
Stabilizability based state space reductions for hybrid systems <i>E. De Santis, M.D. Di Benedetto, G. Pola</i>	112
Reachability computation for uncertain planar affine systems using linear abstractions <i>O. Nasri, M.-A. Lefebvre, H. Guéguen</i>	118
Exact differentiation via sliding mode observer for switched systems <i>H. Saadaoui, M. Djemai, N. Manamanni, T. Floquet, J.-P. Barbot</i>	124

**WC2 - Control of Hybrid Systems 2**

Robust H-infinity control of uncertain discrete-time switching symmetric composite systems <i>L. Bakule</i>	130
The elevator dispatching problem: hybrid system modeling and receding horizon control <i>K.S. Wesselowski, C.G. Cassandras</i>	136
Robust piecewise linear sheet control in a printer paper path <i>B. Bokkems, J. de Best, R. van de Molengraft, M. Steinbuch</i>	142
Stabilization of max-plus-linear systems using receding horizon control – The unconstrained case <i>I. Necoara, T.J.J. van den Boom, B. De Schutter, J. Hellendoorn</i>	148

**TA1 - Stochastic Hybrid Systems**

Online classification of switching models based on subspace framework <i>K.M. Pekpe, S. Lecoeuche</i>	154
Functional abstractions of stochastic hybrid systems <i>M.L. Bujorianu, H.A.P. Blom, H. Hermanns</i>	160
Stochastic hybrid NETCAD systems for modeling call admission and routing control in networks <i>Z. Ma, P.E. Caines, R. Malhamé</i>	166
Parameter identification for piecewise deterministic Markov processes: a case study on a biochemical network <i>P. Kouretas, K. Koutoumpas, J. Lygeros</i>	172
Using path integral short time propagators for numerical analysis of stochastic hybrid systems <i>G. Lichtenberg, P. Rostalski</i>	179

**TA2 - Controller Design Based on Hybrid Models of Industrial Plants (Invited)**Organizers: *S. Engell, O. Stursberg*

Challenges in start-up control of a heat exchange reactor with exothermic reactions; a hybrid approach <i>S. Haugwitz, P. Hagander</i>	185
Feedback stabilization of the operation of an hybrid chemical plant <i>I. Simeonova, F. Warichet, G. Bastin, D. Dochain, Y. Pochet</i>	191
A solar cooling plant: a benchmark for hybrid systems control <i>D. Zambrano, C. Bordons, W. García-Gabín, E. F. Camacho</i>	199
Timed discrete event control of a parallel production line with continuous output <i>D. Gromov, S. Geist, J. Raisch</i>	205
Dynamic optimization of an industrial evaporator using graph search with embedded nonlinear programming <i>C. Sonntag, O. Stursberg, S. Engell</i>	211

**TB1 - Diagnosis and Identification**

Using neural networks for the identification of a class of hybrid dynamic systems <i>N. Messai, J. Zaytoon, B. Riera</i>	217
Fault tolerant control design for switched systems <i>M. Rodrigues, D. Theilliol, D. Sauter</i>	223
Discrete-event modelling and fault diagnosis of discretely controlled continuous systems <i>J. Lunze</i>	229
Use of an object oriented dynamic hybrid simulator for the monitoring of industrial processes <i>N. Olivier, G. Hétreux, J.-M. Le Lann, M.-V. Le Lann</i>	235

**TB2 - Applications of Hybrid Control (Invited)**Organizers: *A. Bemporad, F. Lamnabhi-Lagarrigue*

Model predictive control of nonlinear mechatronic systems: an application to a magnetically actuated mass spring damper <i>S. Di Cairano, A. Bemporad, I. Kolmanovsky, D. Hrovat</i>	241
Subtleties in the averaging of hybrid systems with applications to power electronics <i>L. Iannelli, K.H. Johansson, U. Jönsson, F. Vasca</i>	247
Adaptive cruise controller design: a comparative assessment for PWA systems <i>D. Corona, B. De Schutter</i>	253
Idle speed control - a benchmark for hybrid system research <i>A. Balluchi, L. Benvenuti, M.D. Di Benedetto, T. Villa, A.L. Sangiovanni-Vincentelli</i>	259

**TC1 - Hybrid Simulation Tools: Principles, Challenges and Applications (Invited)**Organizers: *C.G. Cassandras, P. Mosterman*

Simulation and verification of hybrid systems using Chi <i>D.A. van Beek, J.E. Rooda, R.R.H. Schiffelers</i>	265
Hybrid system simulation with SIMEVENTS <i>C.G. Cassandras, M.I. Clune, P.J. Mosterman</i>	267

HyVisual: a hybrid system modeling framework based on Ptolemy II <i>E.A. Lee, H. Zheng</i>	270
TrueTime: simulation of networked computer control systems <i>D. Henriksson, A. Cervin, M. Andersson, K.-E. Arzen</i>	272
CODIS - A framework for continuous/discrete systems co-simulation <i>G. Niculescu, F. Bouchhima, L. Gheorghe</i>	274
<b>TC2 - Stability 1</b>	
On the finite-time stabilization of a nonlinear uncertain dynamics via switched control <i>G. Bartolini, A. Pisano, E. Usai</i>	276
Search for period-2 cycles in a class of hybrid dynamical systems with autonomous switchings. Application to a thermal device <i>C. Quémard, J.-C. Jolly, J.-L. Ferrier</i>	283
Stabilizability of bimodal piecewise linear systems with continuous vector field <i>K. Camlibel, M. Heemels, H. Schumacher</i>	290
Global input-to-state stability and stabilization of discrete-time piece-wise affine systems <i>M. Lazar, W.P.M.H. Heemels</i>	296
<b>FA1 - Model Predictive Control</b>	
Feasible mode enumeration and cost comparison for explicit quadratic model predictive control of hybrid systems <i>A. Alessio, A. Bemporad</i>	302
An efficient algorithm for predictive control of piecewise affine systems with mixed inputs <i>S. Leirens, J. Buisson</i>	309
Explicit model predictive control of the boost DC-DC converter <i>A.G. Beccuti, G. Papafotiou, M. Morari</i>	315
A new dual-mode hybrid MPC algorithm with a robust stability guarantee <i>M. Lazar, W.P.M.H. Heemels</i>	321
Robust model predictive control for piecewise affine systems subject to bounded disturbances <i>J. Thomas, S. Olaru, J. Buisson, D. Dumur</i>	329
<b>FA2 - Stability 2</b>	
Stabilization of switched linear systems with unknown time varying delays <i>L. Hetel, J. Daafouz, C. Iung</i>	335
Stabilizing dynamic controller of switched linear systems <i>S. Chaib, A. Benali, D. Boutat, J.-P. Barbot</i>	341
Dynamic output feedback stabilization of continuous-time switched systems <i>J.C. Geromel, P. Colaneri</i>	347
Practical stabilization of discrete-time linear LTI SISO systems under assigned input and output quantization <i>B. Picasso, A. Bicchi</i>	353
Box invariance of hybrid and switched systems <i>A. Abate, A. Tiwari</i>	359

**FB1 - Verification and Safety**

Performance verification of discrete event systems using hybrid model-checking <i>B. Denis, J.-J. Lesage, Z. Juárez-Orozco</i>	365
Verification-integrated falsification of non-deterministic hybrid systems <i>S. Ratschan, J.-G. Smaus</i>	371
An evaluation of two recent reachability analysis tools for hybrid systems <i>I. Ben Makhoul, S. Kowalewski</i>	377
Safety and reliability analysis of protection systems for power systems <i>L. Ferrarini, L. Ambrosi, E. Ciapessoni</i>	383
A hybrid approach for safety analysis of aircraft systems <i>E. Villani, P.E. Miyagi</i>	389

**FB2 - Abstraction Based Approaches to Hybrid Control**

Detecting and enforcing monotonicity for hybrid control systems synthesis <i>D. Gromov, J. Raisch</i>	395
Hybrid system control using an on-line discrete event supervisory strategy <i>J. Millan, S. O'Young</i>	402
Non-deterministic reactive systems, from hybrid systems and behavioural systems perspectives <i>J.M. Davoren, T. Moor</i>	409
Control-invariance of sampled-data hybrid systems with periodically clocked events and jitter <i>Y. Tsuchie, T. Ushio</i>	417

---

<b>Author Index</b>	423
---------------------	-----