

Claire J. Tomlin

Mark R. Greenstreet (Eds.)

Hybrid Systems: Computation and Control

5th International Workshop, HSCC 2002
Stanford, CA, USA, March 2002
Proceedings

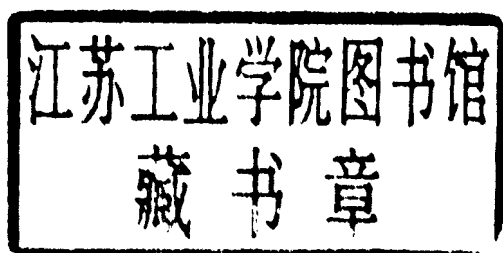


Springer

Claire J. Tomlin Mark R. Greenstreet (Eds.)

Hybrid Systems: Computation and Control

5th International Workshop, HSCC 2002
Stanford, CA, USA, March 25-27, 2002
Proceedings



Springer

Series Editors

Gerhard Goos, Karlsruhe University, Germany
Juris Hartmanis, Cornell University, NY, USA
Jan van Leeuwen, Utrecht University, The Netherlands

Volume Editors

Claire J. Tomlin
Stanford University, Department of Aeronautics and Astronautics
250 Durand Building MC4035, Stanford, CA 94305-4035, USA
E-mail: tomlin@stanford.edu

Mark R. Greenstreet
University of British Columbia, Department of Computer Science
201-2366 Main Mall, Vancouver BC, V6T 1Z4, Canada
E-mail: mrg@cs.ubc.ca

Cataloging-in-Publication Data applied for

Die Deutsche Bibliothek - CIP-Einheitsaufnahme

Hybrid systems : computation and control ; 5th international workshop ;
proceedings / HSCC 2002, Stanford, CA, USA, March 25 - 27, 2002. Claire
J. Tomlin ; Mark R. Greenstreet (ed.). - Berlin ; Heidelberg ; New York ;
Barcelona ; Hong Kong ; London ; Milan ; Paris ; Tokyo : Springer, 2002
(Lecture notes in computer science ; Vol. 2289)
ISBN 3-540-43321-X

CR Subject Classification (1998): C.3, C.1.m, F.3, D.2, F.1.2, J.2, I.6

ISSN 0302-9743

ISBN 3-540-43321-X Springer-Verlag Berlin Heidelberg New York

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer-Verlag. Violations are liable for prosecution under the German Copyright Law.

Springer-Verlag Berlin Heidelberg New York
a member of BertelsmannSpringer Science+Business Media GmbH

<http://www.springer.de>

© Springer-Verlag Berlin Heidelberg 2002
Printed in Germany

Typesetting: Camera-ready by author, data conversion by Boller Mediendesign
Printed on acid-free paper SPIN: 10846351 06/3142 5 4 3 2 1 0

Springer

Berlin

Heidelberg

New York

Barcelona

Hong Kong

London

Milan

Paris

Tokyo

Preface

This volume contains the proceedings of the *Fifth Workshop on Hybrid Systems: Computation and Control* (HSCC 2002), which was held in Stanford, California during March 25-27, 2002. The Hybrid Systems Workshops attract researchers interested in the modeling, analysis, control, and implementation of systems which involve the interaction of both discrete and continuous state dynamics. The newest results and latest developments in hybrid system models, formal methods for analysis and control, computational tools, as well as new applications and examples are presented at these annual meetings.

The Fifth Workshop continues the series of workshops held in Grenoble, France (HART'97), Berkeley, California, USA (HSCC'98), Nijmegen, The Netherlands (HSCC'99), Pittsburgh, Pennsylvania, USA (HSCC 2000), and Rome, Italy (HSCC 2001). Proceedings of these workshops have been published by Springer-Verlag, in the Lecture Notes for Computer Science (LNCS) series.

This year, we assembled a technical program committee with a broad expertise in formal methods in computer science, control theory, software engineering, numerical analysis and artificial intelligence; as well as experts in science and industry who are working in the application of hybrid system methods to problems in their domains. In response to our Call for Papers, 73 high quality manuscripts were submitted. After detailed review and discussion of these papers by the program committee, 33 papers were accepted for presentation at the workshop, and the final versions of these papers appear in this volume.

As is the tradition established by previous workshops, the accepted papers span an exciting range of topics, from formal methods of model abstraction, refinement and reduction, to fault diagnosis and recovery, to new methods for synthesizing and analyzing control for hybrid systems. As the theory of hybrid systems starts to mature, we are aware of the importance of good application of this theory: we are happy to include a strong set of application papers, including the hybrid analysis of engine control and power systems, robotic assemblies and smart actuators. Also, now that computational problems in hybrid systems are coming to the fore, we are pleased to note the growing interest in the development of sound numerical techniques for hybrid systems analysis, and to include several numerical papers in this volume.

We are pleased to acknowledge the National Science Foundation and Stanford University for financial support of this workshop. We thank our Program Committee for their technical support in reviewing the papers. Finally, our great thanks goes to our Organizing Committee, including Ian Mitchell, who installed and managed the automatic software for paper submission and review, Ronojoy

Ghosh, who designed the conference web site and managed the computer server, and to Sherann Ellsworth and Dana Parga, who organized and handled all of the local arrangements of venues, catering, hotels, and registration.

March 2002

Claire J. Tomlin
Mark R. Greenstreet
Workshop Co-Chairs
Stanford University, Stanford CA

Organization

Steering Committee

Panos Antsaklis (University of Notre Dame)
Maria Domenica Di Benedetto (University of L'Aquila, Italy)
Mark Greenstreet (University of British Columbia)
Thomas A. Henzinger (University of California, Berkeley)
Bruce H. Krogh (Carnegie Mellon University)
Nancy Lynch (Massachusetts Institute of Technology)
Oded Maler (VERIMAG, France)
Manfred Morari (Swiss Federal Institute of Technology, ETH, Zürich)
Amir Pnueli (Weizmann Institute, Israel)
Anders Ravn (Aalborg University, Denmark)
Alberto Sangiovanni-Vincentelli (PARADES; University of California, Berkeley)
Claire J. Tomlin (Stanford University)
Jan H. van Schuppen (CWI, Amsterdam, The Netherlands)
Frits Vaandrager (University of Nijmegen, The Netherlands)

Program Committee

Rajeev Alur (University of Pennsylvania)
Eugene Asarin (VERIMAG, France)
Uri Ascher (University of British Columbia)
Panos Antsaklis (University of Notre Dame)
Gautam Biswas (Vanderbilt University)
Michael Branicky (Case Western Reserve University)
Ken Butts (Ford Research Laboratory)
Christos G. Cassandras (Boston University)
David Dill (Stanford University)
Maria Domenica Di Benedetto (University of L'Aquila, Italy)
Datta Godbole (Honeywell Labs)
Mark Greenstreet (University of British Columbia)
João Hespanha (University of California, Santa Barbara)
Thomas A. Henzinger (University of California, Berkeley)
Bruce H. Krogh (Carnegie Mellon University)
Alexander B. Kurzhanski (Moscow State University)
Stefan Kowalewski (Bosch, Germany)
Michael Lemmon (University of Notre Dame)
Nancy Leveson (Massachusetts Institute of Technology)
Nancy Lynch (Massachusetts Institute of Technology)
John Lygeros (University of Cambridge, UK)
Oded Maler (VERIMAG, France)

Sheila McIlraith (Stanford University)
 Manfred Morari (Swiss Federal Institute of Technology, ETH, Zürich)
 Pieter Mosterman (Institute of Robotics and Mechatronics, DLR, Germany)
 George Pappas (University of Pennsylvania)
 Linda Petzold (University of California, Santa Barbara)
 Maria Prandini (University of Brescia, Italy)
 Anders Rantzer (Lund Institute of Technology, Sweden)
 Anders Ravn (Aalborg University, Denmark)
 Harvey Rubin (University of Pennsylvania)
 Patrick Saint-Pierre (University of Paris-Dauphine, France)
 Alberto Sangiovanni-Vincentelli (PARADES; University of California, Berkeley)
 Shankar Sastry (University of California, Berkeley)
 Janos Sztipanovits (Vanderbilt University)
 Claire J. Tomlin (Stanford University)
 Frits Vaandrager (University of Nijmegen, The Netherlands)
 Arjan van der Schaft (University of Twente, Enschede, The Netherlands)
 Jan H. van Schuppen (CWI, Amsterdam, The Netherlands)
 Brian Williams (Massachusetts Institute of Technology)

Additional Referees

Sherif Abdelwahed	Emilio Frazzoli	C. G. Panayiotou
Palle Andersen	Goran Frehse	Giordano Pola
Andrea Balluchi	Robert Goldman	Shawn Schaffert
Alexandre Bayen	J.W. Goodwine	Henrik Schiøler
Calin Belta	Ronojoy Ghosh	Ying Shang
Alberto Bemporad	Maurice Heemels	Oleg Sokolsky
Antonio Bicchi	M. Iordache	Thomas Steffen
Francesco Borrelli	R. Izadi-Zamanabadi	Olaf Stursberg
Paul Caspi	T. John Koo	Ye Sun
Cenk Çavuşoğlu	X. Koutsoukos	Paulo Tabuada
Eva Crück	Salvatore La Torre	Fabio Torrisi
Thao Dang	Daniel Liberzon	Herbert Tanner
Elena De Santis	Hai Lin	Lothar Thiele
Stefano Di Gennaro	Qiang Ling	René Vidal
Sebastian Engell	Domenico Mignone	Rafael Wiesnewski
Lei Fang	Ian Mitchell	Sergio Yovine
Ansgar Fehnker	Supratik Mukhopadhyay	Jun Zhang
G. Ferrari-Trecate	Luigi Palopoli	Wenyi Zhang

Organizing Committee

Sherann Ellsworth
 Ronojoy Ghosh
 Mark Greenstreet

Ian Mitchell
Dana Parga
Claire Tomlin

Sponsoring Institutions

National Science Foundation
Stanford University

Author Index

- Aaron, Eric, 7
Altafini, Claudio, 21
Alur, Rajeev, 35
Antoine, Marc, 209
Asarin, Eugene, 49
Ascher, Uri M., 3
Aubin, Jean-Pierre, 62
- Balluchi, Andrea, 76
Baras, John S., 451
Bayen, Alexandre M., 90
Bemporad, Alberto, 105
Benedetto, Maria D. Di, 76
Benvenuti, Luca, 76
Bicchi, Antonio, 337, 351
Biswas, Gautam, 308
Borrelli, Francesco, 105
Branicky, Michael S., 120
- Cassez, Franck, 134
Chhatpar, Siddharth R., 120
Christofides, Panagiotis D., 164
Crück, Eva, 90
Cuzzola, Francesco A., 194
- Dang, Thao, 35
Davoren, J.M., 149
Dordan, Olivier, 62
- El-Farra, Nael H., 164
Elghaoui, Laurent, 337
Elia, Nicola, 179
- Ferrari-Trecate, Giancarlo, 194, 209
Frazzoli, Emilio, 179
- Gallestey, Eduardo, 209
Goldman, Robert P., 225
- Henzinger, Thomas A., 5, 134
Hespanha, João P., 239
Hofbaur, Michael W., 253
Hu, Jianghai, 267
- Ivančić, Franjo, 7, 35
- Johansson, Karl Henrik, 21
- Khanna, Gaurav, 465
Koo, T. John, 281
Kuipers, Benjamin, 294
- Leonardi, Laura, 351
Letizia, Paolo, 209
Lima, Pedro, 436
- Metaxas, Dimitris, 7
Moor, T., 149
Morari, Manfred, 105, 194, 209
Musliner, David J., 225
- Narasimhan, Sriram, 308
Neller, Todd W., 323
Nerode, A., 149
- Pallottino, Lucia, 351
Palopoli, Luigi, 337
Pancanti, Stefania, 351
Panek, Sebastian, 421
Pappas, George J., 436
Pasternak, Tal, 364
Pelican, Michael J.S., 225
Pinello, Claudio, 337
- Ramamoorthy, Subramanian, 294
Raskin, Jean-François, 134
- Saint-Pierre, Patrick, 378
Sangiovanni-Vincentelli, Alberto L., 76, 337
Sastry, Shankar, 267, 281
Schneider, Gerardo, 49
Sethian, James A., 393
Sharp, David, 1
Spedicato, Matteo, 209
Speranzon, Alberto, 21
Stauner, Thomas, 407
Stursberg, Olaf, 421
- Tabuada, Paulo, 436
Tan, Xiaobo, 451
Tiwari, Ashish, 465
Tomlin, Claire J., 90

Vladimirsky, Alexander, 393

Yovine, Sergio, 49

Williams, Brian C., 253

Lecture Notes in Computer Science

For information about Vols. 1–2201
please contact your bookseller or Springer-Verlag

- Vol. 2202: A. Restivo, S. Ronchi Della Rocca, L. Roversi (Eds.), *Theoretical Computer Science. Proceedings*, 2001. XI, 440 pages. 2001.
- Vol. 2203: A. Omicini, P. Petta, R. Tolksdorf (Eds.), *Engineering Societies in the Agents World II. Proceedings*, 2001. XI, 195 pages. 2001. (Subseries LNAI).
- Vol. 2204: A. Brandstädt, V.B. Le (Eds.), *Graph-Theoretic Concepts in Computer Science. Proceedings*, 2001. X, 329 pages. 2001.
- Vol. 2205: D.R. Montello (Ed.), *Spatial Information Theory. Proceedings*, 2001. XIV, 503 pages. 2001.
- Vol. 2206: B. Reusch (Ed.), *Computational Intelligence. Proceedings*, 2001. XVII, 1003 pages. 2001.
- Vol. 2207: I.W. Marshall, S. Nettles, N. Wakamiya (Eds.), *Active Networks. Proceedings*, 2001. IX, 165 pages. 2001.
- Vol. 2208: W.J. Niessen, M.A. Viergever (Eds.), *Medical Image Computing and Computer-Assisted Intervention – MICCAI 2001. Proceedings*, 2001. XXXV, 1446 pages. 2001.
- Vol. 2209: W. Jonker (Ed.), *Databases in Telecommunications II. Proceedings*, 2001. VII, 179 pages. 2001.
- Vol. 2210: Y. Liu, K. Tanaka, M. Iwata, T. Higuchi, M. Yasunaga (Eds.), *Evolvable Systems: From Biology to Hardware. Proceedings*, 2001. XI, 341 pages. 2001.
- Vol. 2211: T.A. Henzinger, C.M. Kirsch (Eds.), *Embedded Software. Proceedings*, 2001. IX, 504 pages. 2001.
- Vol. 2212: W. Lee, L. Mé, A. Wespi (Eds.), *Recent Advances in Intrusion Detection. Proceedings*, 2001. X, 205 pages. 2001.
- Vol. 2213: M.J. van Sinderen, L.J.M. Nieuwenhuis (Eds.), *Protocols for Multimedia Systems. Proceedings*, 2001. XII, 239 pages. 2001.
- Vol. 2214: O. Boldt, H. Jürgensen (Eds.), *Automata Implementation. Proceedings*, 1999. VIII, 183 pages. 2001.
- Vol. 2215: N. Kobayashi, B.C. Pierce (Eds.), *Theoretical Aspects of Computer Software. Proceedings*, 2001. XV, 561 pages. 2001.
- Vol. 2216: E.S. Al-Shaer, G. Pacifici (Eds.), *Management of Multimedia on the Internet. Proceedings*, 2001. XIV, 373 pages. 2001.
- Vol. 2217: T. Gomi (Ed.), *Evolutionary Robotics. Proceedings*, 2001. XI, 139 pages. 2001.
- Vol. 2218: R. Guerraoui (Ed.), *Middleware 2001. Proceedings*, 2001. XIII, 395 pages. 2001.
- Vol. 2219: S.T. Taft, R.A. Duff, R.L. Brukardt, E. Plöedereder (Eds.), *Consolidated Ada Reference Manual. XXV*, 560 pages. 2001.
- Vol. 2220: C. Johnson (Ed.), *Interactive Systems. Proceedings*, 2001. XII, 219 pages. 2001.
- Vol. 2221: D.G. Feitelson, L. Rudolph (Eds.), *Job Scheduling Strategies for Parallel Processing. Proceedings*, 2001. VII, 207 pages. 2001.
- Vol. 2222: M.J. Wooldridge, G. Weiß, P. Ciancarini (Eds.), *Agent-Oriented Software Engineering II. Proceedings*, 2001. X, 319 pages. 2002.
- Vol. 2223: P. Eades, T. Takaoka (Eds.), *Algorithms and Computation. Proceedings*, 2001. XIV, 780 pages. 2001.
- Vol. 2224: H.S. Kunii, S. Jajodia, A. Sølvberg (Eds.), *Conceptual Modeling – ER 2001. Proceedings*, 2001. XIX, 614 pages. 2001.
- Vol. 2225: N. Abe, R. Khardon, T. Zeugmann (Eds.), *Algorithmic Learning Theory. Proceedings*, 2001. XI, 379 pages. 2001. (Subseries LNAI).
- Vol. 2226: K.P. Jantke, A. Shinohara (Eds.), *Discovery Science. Proceedings*, 2001. XII, 494 pages. 2001. (Subseries LNAI).
- Vol. 2227: S. Boztaş, I.E. Shparlinski (Eds.), *Applied Algebra, Algebraic Algorithms and Error-Correcting Codes. Proceedings*, 2001. XII, 398 pages. 2001.
- Vol. 2228: B. Monien, V.K. Prasanna, S. Vajapeyam (Eds.), *High Performance Computing – HiPC 2001. Proceedings*, 2001. XVIII, 438 pages. 2001.
- Vol. 2229: S. Qing, T. Okamoto, J. Zhou (Eds.), *Information and Communications Security. Proceedings*, 2001. XIV, 504 pages. 2001.
- Vol. 2230: T. Katila, I.E. Magnin, P. Clarysse, J. Montagnat, J. Nenonen (Eds.), *Functional Imaging and Modeling of the Heart. Proceedings*, 2001. XI, 158 pages. 2001.
- Vol. 2231: A. Pasetti, *Software Frameworks and Embedded Control Systems. XIV*, 293 pages. 2002.
- Vol. 2232: L. Fiege, G. Mühl, U. Wilhelm (Eds.), *Electronic Commerce. Proceedings*, 2001. X, 233 pages. 2001.
- Vol. 2233: J. Crowcroft, M. Hofmann (Eds.), *Networked Group Communication. Proceedings*, 2001. X, 205 pages. 2001.
- Vol. 2234: L. Pacholski, P. Ružička (Eds.), *SOFSEM 2001: Theory and Practice of Informatics. Proceedings*, 2001. XI, 347 pages. 2001.
- Vol. 2235: C.S. Calude, G. Păun, G. Rozenberg, A. Salomaa (Eds.), *Multiset Processing. VIII*, 359 pages. 2001.
- Vol. 2236: K. Drira, A. Martelli, T. Villemur (Eds.), *Cooperative Environments for Distributed Systems Engineering. IX*, 281 pages. 2001.
- Vol. 2237: P. Codognot (Ed.), *Logic Programming. Proceedings*, 2001. XI, 365 pages. 2001.
- Vol. 2239: T. Walsh (Ed.), *Principles and Practice of Constraint Programming – CP 2001. Proceedings*, 2001. XIV, 788 pages. 2001.

- Vol. 2240: G.P. Picco (Ed.), *Mobile Agents. Proceedings*, 2001. XIII, 277 pages. 2001.
- Vol. 2241: M. Jünger, D. Naddef (Eds.), *Computational Combinatorial Optimization*. IX, 305 pages. 2001.
- Vol. 2242: C.A. Lee (Ed.), *Grid Computing – GRID 2001. Proceedings*, 2001. XII, 185 pages. 2001.
- Vol. 2243: G. Bertrand, A. Imiya, R. Klette (Eds.), *Digital and Image Geometry*. VII, 455 pages. 2001.
- Vol. 2244: D. Bjørner, M. Broy, A.V. Zamulin (Eds.), *Perspectives of System Informatics. Proceedings*, 2001. XIII, 548 pages. 2001.
- Vol. 2245: R. Hariharan, M. Mukund, V. Vinay (Eds.), *FST TCS 2001: Foundations of Software Technology and Theoretical Computer Science. Proceedings*, 2001. XI, 347 pages. 2001.
- Vol. 2246: R. Falcone, M. Singh, Y.-H. Tan (Eds.), *Trust in Cyber-societies*. VIII, 195 pages. 2001. (Subseries LNAI).
- Vol. 2247: C. P. Rangan, C. Ding (Eds.), *Progress in Cryptology – INDOCRYPT 2001. Proceedings*, 2001. XIII, 351 pages. 2001.
- Vol. 2248: C. Boyd (Ed.), *Advances in Cryptology – ASIACRYPT 2001. Proceedings*, 2001. XI, 603 pages. 2001.
- Vol. 2249: K. Nagi, *Transactional Agents*. XVI, 205 pages. 2001.
- Vol. 2250: R. Nieuwenhuis, A. Voronkov (Eds.), *Logic for Programming, Artificial Intelligence, and Reasoning. Proceedings*, 2001. XV, 738 pages. 2001. (Subseries LNAI).
- Vol. 2251: Y.Y. Tang, V. Wickerhauser, P.C. Yuen, C.Li (Eds.), *Wavelet Analysis and Its Applications. Proceedings*, 2001. XIII, 450 pages. 2001.
- Vol. 2252: J. Liu, P.C. Yuen, C. Li, J. Ng, T. Ishida (Eds.), *Active Media Technology. Proceedings*, 2001. XII, 402 pages. 2001.
- Vol. 2253: T. Terano, T. Nishida, A. Namatame, S. Tsumoto, Y. Ohsawa, T. Washio (Eds.), *New Frontiers in Artificial Intelligence. Proceedings*, 2001. XXVII, 553 pages. 2001. (Subseries LNAI).
- Vol. 2254: M.R. Little, L. Nigay (Eds.), *Engineering for Human-Computer Interaction. Proceedings*, 2001. XI, 359 pages. 2001.
- Vol. 2255: J. Dean, A. Gravel (Eds.), *COTS-Based Software Systems. Proceedings*, 2002. XIV, 257 pages. 2002.
- Vol. 2256: M. Stumptner, D. Corbett, M. Brooks (Eds.), *AI 2001: Advances in Artificial Intelligence. Proceedings*, 2001. XII, 666 pages. 2001. (Subseries LNAI).
- Vol. 2257: S. Krishnamurthi, C.R. Ramakrishnan (Eds.), *Practical Aspects of Declarative Languages. Proceedings*, 2002. VIII, 351 pages. 2002.
- Vol. 2258: P. Brazdil, A. Jorge (Eds.), *Progress in Artificial Intelligence. Proceedings*, 2001. XII, 418 pages. 2001. (Subseries LNAI).
- Vol. 2259: S. Vaudenay, A.M. Youssef (Eds.), *Selected Areas in Cryptography. Proceedings*, 2001. XI, 359 pages. 2001.
- Vol. 2260: B. Honary (Ed.), *Cryptography and Coding. Proceedings*, 2001. IX, 416 pages. 2001.
- Vol. 2262: P. Müller, *Modular Specification and Verification of Object-Oriented Programs*. XIV, 292 pages. 2002.
- Vol. 2263: T. Clark, J. Warmer (Eds.), *Object Modeling with the OCL*. VIII, 281 pages. 2002.
- Vol. 2264: K. Steinhöfel (Ed.), *Stochastic Algorithms: Foundations and Applications. Proceedings*, 2001. VIII, 203 pages. 2001.
- Vol. 2265: P. Mutzel, M. Jünger, S. Leipert (Eds.), *Graph Drawing. Proceedings*, 2001. XV, 524 pages. 2002.
- Vol. 2266: S. Reich, M.T. Tzagarakis, P.M.E. De Bra (Eds.), *Hypermedia: Openness, Structural Awareness, and Adaptivity. Proceedings*, 2001. X, 335 pages. 2002.
- Vol. 2267: M. Cerioli, G. Reggio (Eds.), *Recent Trends in Algebraic Development Techniques. Proceedings*, 2001. X, 345 pages. 2001.
- Vol. 2268: E.F. Deprettere, J. Teich, S. Vassiliadis (Eds.), *The Design of Complex Embedded Systems*. VIII, 327 pages. 2002.
- Vol. 2270: M. Pflanz, *On-line Error Detection and Fast Recover Techniques for Dependable Embedded Processors*. XII, 126 pages. 2002.
- Vol. 2271: B. Preneel (Ed.), *Topics in Cryptology – CT-RSA 2002. Proceedings*, 2002. X, 311 pages. 2002.
- Vol. 2272: D. Bert, J.P. Bowen, M.C. Henson, K. Robinson (Eds.), *ZB 2002: Formal Specification and Development in Z and B. Proceedings*, 2002. XII, 535 pages. 2002.
- Vol. 2273: A.R. Coden, E.W. Brown, S. Srinivasan (Eds.), *Information Retrieval Techniques for Speech Applications*. XI, 109 pages. 2002.
- Vol. 2274: D. Naccache, P. Paillier (Eds.), *Public Key Cryptography. Proceedings*, 2002. XI, 385 pages. 2002.
- Vol. 2275: N.R. Pal, M. Sugeno (Eds.), *Advances in Soft Computing – AFSS 2002. Proceedings*, 2002. XVI, 536 pages. 2002. (Subseries LNAI).
- Vol. 2276: A. Gelbukh (Ed.), *Computational Linguistics and Intelligent Text Processing. Proceedings*, 2002. XIII, 444 pages. 2002.
- Vol. 2277: P. Callaghan, Z. Luo, J. McKinna, R. Pollack (Eds.), *Types for Proofs and Programs. Proceedings*, 2000. VIII, 243 pages. 2002.
- Vol. 2284: T. Eiter, K.-D. Schewe (Eds.), *Foundations of Information and Knowledge Systems. Proceedings*, 2002. X, 289 pages. 2002.
- Vol. 2285: H. Alt, A. Ferreira (Eds.), *STACS 2002. Proceedings*, 2002. XIV, 660 pages. 2002.
- Vol. 2288: K. Kim (Ed.), *Information Security and Cryptology – ICISC 2001. Proceedings*, 2001. XIII, 457 pages. 2002.
- Vol. 2289: C.J. Tomlin, M.R. Greenstreet (Eds.), *Hybrid Systems: Computation and Control. Proceedings*, 2002. XIII, 480 pages. 2002.
- Vol. 2292: G.B. Khosrovshahi, A. Shokoufandeh, A. Shokrollahi (Eds.), *Theoretical Aspects of Computer Science*. IX, 221 pages. 2002.
- Vol. 2300: W. Brauer, H. Ehrig, J. Karhumäki, A. Salomaa (Eds.), *Formal and Natural Computing*. XXXVI, 431 pages. 2002.

Table of Contents

Abstracts of Invited Presentations

Hybrid and Embedded Software Technologies for Production Large-Scale Systems	1
<i>David Sharp</i>	
Numerical Methods for Differential Systems with Algebraic Equality and Inequality Constraints	3
<i>Uri M. Ascher</i>	
From Models to Code: The Missing Link in Embedded Software	5
<i>Thomas A. Henzinger</i>	

Papers

Hybrid System Models of Navigation Strategies for Games and Animations	7
<i>Eric Aaron, Franjo Ivančić, Dimitris Metaxas</i>	
Hybrid Control of a Truck and Trailer Vehicle	21
<i>Claudio Altafini, Alberto Speranzon, Karl Henrik Johansson</i>	
Reachability Analysis of Hybrid Systems via Predicate Abstraction	35
<i>Rajeev Alur, Thao Dang, Franjo Ivančić</i>	
Towards Computing Phase Portraits of Polygonal Differential Inclusions ..	49
<i>Eugene Asarin, Gerardo Schneider, Sergio Yovine</i>	
Dynamical Qualitative Analysis of Evolutionary Systems	62
<i>Jean-Pierre Aubin, Olivier Dordan</i>	
Design of Observers for Hybrid Systems	76
<i>Andrea Balluchi, Luca Benvenuti, Maria D. Di Benedetto, Alberto L. Sangiovanni-Vincentelli</i>	
Guaranteed Overapproximations of Unsafe Sets for Continuous and Hybrid Systems: Solving the Hamilton-Jacobi Equation Using Viability Techniques	90
<i>Alexandre M. Bayen, Eva Crück, Claire J. Tomlin</i>	
On the Optimal Control Law for Linear Discrete Time Hybrid Systems ..	105
<i>Alberto Bemporad, Francesco Borrelli, Manfred Morari</i>	

A Computational Framework for the Verification and Synthesis of Force-Guided Robotic Assembly Strategies	120
<i>Michael S. Branicky, Siddharth R. Chhatpar</i>	
A Comparison of Control Problems for Timed and Hybrid Systems	134
<i>Franck Cassez, Thomas A. Henzinger, Jean-François Raskin</i>	
Hybrid Control Loops, A/D Maps, and Dynamic Specifications	149
<i>J.M. Davoren, T. Moor, A. Nerode</i>	
Switching and Feedback Laws for Control of Constrained Switched Nonlinear Systems	164
<i>Nael H. El-Farra, Panagiotis D. Christofides</i>	
Quantized Stabilization of Two-Input Linear Systems: A Lower Bound on the Minimal Quantization Density	179
<i>Nicola Elia, Emilio Frazzoli</i>	
Analysis of Discrete-Time PWA Systems with Logic States	194
<i>Giancarlo Ferrari-Trecate, Francesco A. Cuzzola, Manfred Morari</i>	
Modeling and Control of Co-generation Power Plants: A Hybrid System Approach	209
<i>Giancarlo Ferrari-Trecate, Eduardo Gallestey, Paolo Letizia, Matteo Spedicato, Manfred Morari, Marc Antoine</i>	
Exploiting Implicit Representations in Timed Automaton Verification for Controller Synthesis	225
<i>Robert P. Goldman, David J. Musliner, Michael J.S. Pelican</i>	
Computation of Root-Mean-Square Gains of Switched Linear Systems	239
<i>João P. Hespanha</i>	
Mode Estimation of Probabilistic Hybrid Systems	253
<i>Michael W. Hofbaur, Brian C. Williams</i>	
Symmetry Reduction of a Class of Hybrid Systems	267
<i>Jianghai Hu, Shankar Sastry</i>	
Bisimulation Based Hierarchical System Architecture for Single-Agent Multi-modal Systems	281
<i>T. John Koo, Shankar Sastry</i>	
Qualitative Modeling and Heterogeneous Control of Global System Behavior	294
<i>Benjamin Kuipers, Subramanian Ramamoorthy</i>	
An Approach to Model-Based Diagnosis of Hybrid Systems	308
<i>Sriram Narasimhan, Gautam Biswas</i>	

Information-Based Alpha-Beta Search and the Homicidal Chauffeur	323
<i>Todd W. Neller</i>	
Synthesis of Robust Control Systems under Resource Constraints	337
<i>Luigi Palopoli, Claudio Pinello, Alberto Sangiovanni Vincentelli, Laurent Elghaoui, Antonio Bicchi</i>	
Optimal Control of Quantized Input Systems	351
<i>Stefania Pancanti, Laura Leonardi, Lucia Pallottino, Antonio Bicchi</i>	
Reconfiguration in Hierarchical Control of Piecewise-Affine Systems	364
<i>Tal Pasternak</i>	
Hybrid Kernels and Capture Basins for Impulse Constrained Systems	378
<i>Patrick Saint-Pierre</i>	
Ordered Upwind Methods for Hybrid Control	393
<i>James A. Sethian, Alexander Vladimirsky</i>	
Discrete-Time Refinement of Hybrid Automata	407
<i>Thomas Stauner</i>	
Control of Switched Hybrid Systems Based on Disjunctive Formulations ..	421
<i>Olaf Stursberg, Sebastian Panek</i>	
Composing Abstractions of Hybrid Systems	436
<i>Paulo Tabuada, George J. Pappas, Pedro Lima</i>	
Optimal Control of Hysteresis in Smart Actuators: A Viscosity Solutions Approach	451
<i>Xiaobo Tan, John S. Baras</i>	
Series of Abstractions for Hybrid Automata	465
<i>Ashish Tiwari, Gaurav Khanna</i>	
Author Index	479