

Claudio Bonivento, Alberto Isidori,  
Lorenzo Marconi, Carlo Rossi (Eds.)

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# Advances in Control Theory and Applications



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## Preface

This volume can be considered a direct outcome of the special scientific “meeting-in-the-fortress” on “Advances in Control Theory and Applications” organized in Bertinoro, Italy, by the Centre of research on Complex Automated Systems (CASY), Department of Electronics Computer and Systems of the University of Bologna, during the week May 22–26, 2006. The inspiring idea of that workshop was to provide a forum for exchange of ideas between theory-oriented and application-oriented researchers working on various systems and control problems. The meeting offered an opportunity for formal presentations of research results as well as for informal discussions about ideas and problems, case-studies, limitations and potentials of existing and emerging theories. The main goal of the meeting was to facilitate cross-fertilization between different theoretical and applicative areas. Emphasis was put on identification of new theoretical developments and research directions, as needed by recent progresses in applications and problems which are still looking for a theoretical support and effective rigorous solutions. The technical programme consisted of twenty-five main lectures delivered by distinguished scholars and was complemented by a number of poster presentations prepared by post doctoral fellows and PhD students currently working at CASY. Out of the twenty five lectures given in Bertinoro, fifteen are reported here in written form. They are organized as separate contributions and listed according to the alphabetic order of the first author, as follows.

*Modeling and Control of Autonomous Helicopters* by Manuel Béjar, Anibal Ollero, Federico Cuesta, presents an overview on the modeling and model-based control of autonomous helicopters.

*Efficient Quantization in the Average Consensus Problem* by Ruggero Carli, Sandro Zampieri deals with the average consensus problem where a set of linear systems has to be driven to the same final state which corresponds to the average of their initial states.

*Human-Robot Interaction Control Using Force and Vision* by Agostino De Santis, Vincenzo Lippiello, Bruno Siciliano, Luigi Villani focuses on techniques for augmenting safety by means of control systems, starting from the idea of mimicking sensing and actuation of humans.

*A Dissipation Inequality for the Minimum Phase Property of Nonlinear Control Systems* by Christian Ebenbauer, Frank Allgöwer discusses a new characterization of the minimum phase property of nonlinear control systems in terms of a dissipation inequality.

*Input disturbance suppression for port-Hamiltonian systems: an internal model approach* by Luca Gentili, Andrea Paoli, Claudio Bonivento presents a comprehensive port-Hamiltonian systems framework to deal with input disturbance suppression problems.

*A Systems Theory View of Petri nets* by Alessandro Giua, Carla Seatzu focuses on Petri nets as a family of powerful discrete event models whose interest has grown in parallel with the development of the theory of discrete event systems.

*Wireless Sensing with Power Constraints* by Orhan C. Imer, Tamer Başar introduces two conceptual models for wireless sensing and control with power-limited sensors and controllers.

*The Important State Coordinates of a Nonlinear System* by Arthur J. Krener offers an alternative way of evaluating the relative importance of the state coordinates of a nonlinear control system.

*On Decentralized and Distributed Control of Partially-Observed Discrete Event Systems* by Stéphane Lafortune surveys recent work of the author with several collaborators on decentralized control of discrete event systems.

*A Unifying Approach to the Design of Nonlinear Output Regulators* by Lorenzo Marconi, Alberto Isidori aims to propose a unique vision able to frame a number of results recently proposed in literature to tackle problems of output regulation for nonlinear systems.

*Controller Design through Random Sampling: an Example* by Maria Prandini, Marco C. Campi, Simone Garatti presents the 'scenario approach', an innovative technology for solving convex optimization problems with an infinite number of constraints.

*Digital Control of High Performance Power Supplies for a Synchrotron Light Source* by Carlo Rossi, Andrea Tilli, Manuel Toniato discusses some aspects of an advanced control strategy for a class of quadrupole magnet power supply, where variable output current has to be imposed.

*Distributed PCHD-Systems, from the Lumped to the Distributed Parameter Case* by Kurt Schlacher extends the Hamiltonian approach to a class of distributed parameter Hamiltonian systems, which preserves some useful properties of the well known class of Port Controlled Hamiltonian systems with dissipation.

*Observability and the Design of Fault Tolerant Estimation Using Structural Analysis* by Marcel Staroswiecki presents a structural analysis approach for the design of fault tolerant estimation algorithms.

*Robust hybrid control systems: an overview of some recent results* by Andrew R. Teel gives an overview of a new framework for analyzing hybrid dynamical systems.

We are grateful to all the outstanding colleagues and friends who accepted to participate to the Bertinoro workshop and to contribute to the success of

that initiative with inspiring presentations, fruitful interactions and technical discussions, namely Frank Allgöwer, Karl Åström, Tamer Başar, Marco Campi, Tryphon Georgiou, Alessandro Giua, Lino Guzzella, Arthur Krener, Stéphane Lafortune, Manfred Morari, Steve Morse, Anibal Ollero, Laurent Praly, Anders Rantzer, Giorgio Rizzoni, Kurt Schlacher, Bruno Siciliano, Marcel Staroswiecki, Andrew Teel, Roberto Tempo, Arijan van der Schaft, Yutaka Yamamoto, Sandro Zampieri. We warmly thank in particular those of them who spend time in addition in order to prepare their revised written texts collected in this volume. We are sure that this effort will be useful for many young scientists and skilled professionals operating in different technical areas around the world.

We are indebted with many individuals and institutions for their support and help. In particular, we thank Manfred Morari who promptly accepted our idea of publishing this book in the LNCIS series, Thomas Ditzinger and Heather King, Engineering Editorial of Springer-Verlag, for the precious assistance, Roberto Naldi for the accurate editing work. Finally, the funding supports given by the Institute of Advanced Studies and the Department DEIS both of the University of Bologna, and the hospitality offered by the Bertinoro Residential Centre are gratefully acknowledged.

Bologna,  
28 November, 2006

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