

This is the first time that two of the most reputed conferences in control, the European Control Conference (ECC) and the IEEE Conference on Decision and Control (CDC), are to be celebrated as a joint conference. This important event will take place in an attractive environment, the city of Seville.

The response to our Call for Papers has been extraordinary with 3046 submissions received. The International Program Committee has worked hard and efficiently and, after a rigorous procedure, 1470 papers have been accepted. The number of submissions was much higher than expected and, because of this, only papers that received excellent reviews could be selected.

Two Plenary Sessions, four Semi-Plenary sessions and five tutorial sessions have been programmed for the four days of the Conference. We have chosen a set of outstanding speakers and a wide range of topics to cover not only emerging fields, but also new developments in well established research areas.

Most of the papers are scheduled for oral presentation in 204 sessions, organized in 17 parallel tracks. There is also a significant number (41) of interactive sessions which have been encouraged in this conference as a challenging experience to facilitate interaction between conference attendees. Interactive papers have gone through the same peer review process and are published in the proceedings in the same way as any contributed paper. The reaction to the Call for Workshops has also been very positive. The selected Workshops will be held on Sunday, December 11, prior to the Conference opening. The Conference includes other activities such as panel discussions about important issues in the field.

This joint conference will bring together an international community of experts to discuss the state-of-the-art, new research results, perspectives for future developments, and innovative applications relevant to control, automation, and related areas.

Seville has always been a friendly city open to all cultures with a rich past, a dynamic present, and an exciting future. Situated in Southern Spain, its climate in December is usually mild and dry.

All those attending the CDC-ECC'05 will have the opportunity to participate in a high-level scientific and technical gathering, to share some days with outstanding specialists in Automatic Control from all over the world, and will also understand why Seville is one of the most frequently visited cities in the world.

I look forward to seeing you at the CDC-ECC'05 and encourage you to consider spending a few extra days to enjoy Seville.



Eduardo F Camacho
General Chair

On behalf of the European Union Control Association (EUCA) and the IEEE Control Systems Society (CSS) we wish to welcome you to Seville and the joint CDC-ECC conference; the first time that these two prestigious conferences have been held jointly. This is the 44th IEEE Conference on Decision and Control and the sixth time the CDC has been held outside the United States. Previous CDC's outside the U.S. were Athens in 1986, Brighton in 1991, Kobe in 1996, Sydney in 2000, and The Bahamas in 2004. As the Control Systems Society becomes increasingly international we can expect to see a corresponding increase in the number of CDC's held at international venues. This is also the 8th European Control Conference, and the first one to be held jointly with another event – something that we might see repeated from time to time. Until recently, the EUCA statutes prescribed that ECC conferences could only be held in member states of the European Union. During 2004 the statutes were changed to relax this, so we may well see future ECC's in a wider range of European and neighbouring countries.

The idea of a joint CDC-ECC conference first came up in 1998 during the Presidencies of Michel Gevers (EUCA) and Harris McClamroch (CSS), and immediately received enthusiastic support from both organisations. Detailed planning for this unique event began soon after and we are indebted to the hard work and dedication of numerous individuals, who had to invent creative first-time solutions to many problems dealing with copyright issues, currency and financial issues, as well as a record number of paper submissions. Eduardo F. Camacho, Steve Yurkovich, and Pradeep Misra deserve our special thanks for making this event possible. Roberto Tempo, Franco Blanchini, and Faryar Jabbari also did a superhuman job of putting together the excellent technical program. We are indebted to the entire organizing committee, local support team, area editors, associate editors, and reviewers, without whose volunteer efforts we would not be here to enjoy the hospitality of Seville and the professional interactions with colleagues.

Finally, thanks to you, the participants, for joining us and helping make this first ever collaboration between our two societies a success.



Jan Maciejowski
EUCA President



Mark W. Spong
CSS President

The first joint IEEE Conference on Decision and Control and European Control Conference required the design of a new reviewing process in order to capture the features of both conferences and Societies. This structure is now briefly described together with the main results of the reviewing process.

Hierarchical Structure

In view of the tight schedule and the expected large number of submissions, the reviewing team was structured hierarchically.

All activities were coordinated by myself as Program Chair and by the two Program Vice-Chairs Franco Blanchini and Faryar Jabbari. Under normal conditions, they interacted with Editors (appointed by the Program Chair) responsible for one or more subject areas. In turn, each Editor interacted with a group of Associate Editors. The interaction was exclusive so that an Associate Editor (proposed by an Editor, but formally appointed by the Program Chair) worked with only one Editor.

In case of emergency, the problem was fixed at the previous level. If an Associate Editor was unexpectedly unable to operate, it was an Editor's responsibility to fix the problem by redistributing his/her workload among the remaining members of his/her group (or by assuming the role of Associate Editor). In case of Editor's absence, one of the Program Vice-Chairs coordinated his/her group.

There were 11 Editors and a total of 140 Associate Editors.

Schedule

Three types of submissions have been reviewed for the conference: Regular Papers, Interactive Papers and Invited Sessions (Tutorial Sessions and Workshops followed a different reviewing path). Regular Papers were handled by the Associate Editors and externally reviewed. Interactive Papers were handled with the substantial help of the Chair of Interactive Sessions, Sebastian Dormido, who acted as an Editor in this regard. Invited Sessions were handled by Editors, who obtained a combination of internal (i.e. from Associate Editors) and external reviews. The papers submitted as part of an Invited Session were reviewed both individually and as part of a session.

Overall Results

The results were quite satisfactory. The system proved to be reasonably robust so that more than 3,000 papers have been reviewed and processed without major delays. We observe that this number is much larger than the previous highest submission for CDC or ECC, which was 1879 papers for CDC'04. The rejection rate was quite high for a conference of our community, but close to that of CDC'04. Every effort was made to ensure that at least one review for each paper was available. At the end, the number of papers with no review was equal to zero.

The number of Invited Sessions accepted for the conference was also lower than usual. However, in case of rejection of a session, papers from that session were placed in the pool of Regular Papers and reconsidered individually.

Final publication decisions had to be made on the available reviews provided by the community, Associate Editors' reports and Editors' recommendations. Program Chair, Program Vice-Chairs and Editors met in Portland during ACC'05 to finalize the publication decisions and start building the technical program of the conference. A large number of sessions were tentatively constructed before the meeting.

Specific questions and concerns regarding how the review process was conducted were carefully and individually addressed by the Program Chair in mid July after publication decisions were taken.

Some conference statistics are reported below.

Number of submissions: 3046

Number of accepted papers: 1470

Number of authors (above 100) in the program for each country: USA (967), France (412), Italy (349), Spain (174), United Kingdom (160), Germany (134), Australia (120), Netherlands (115)

Number of reviews: 7480

Conclusions and Acknowledgments

The Conference Management System PaperPlaza, created by Huibert Kwakernaak with the help of Pradeep Misra, proved to be an excellent and indispensable tool for handling such a large number of submissions. Thomas Parisini, Chair of the CSS Conference Editorial Board, provided an outstanding technical support. We thank Huibert, Pradeep and Thomas for safely guiding us through some of the PaperPlaza secrets. We also warmly thank Editors, Associate Editors and reviewers for their substantial contribution during the review process, as well as authors for submitting a record number of high quality papers. The Program Vice-Chairs Franco Blanchini and Faryar Jabbari should be mentioned in a different category for the fundamental role they played for the conference and for their tireless efforts. In their capacity as good friends, they also constantly boosted my energies for several months.

Finally, we believe that the reviewing structure specifically designed for CDC-ECC'05 can be successfully utilized for future EUCA and IEEE conferences, provided that some appropriate modifications are made, with the ultimate objective to improve the quality of our conferences.



Roberto Tempo
Program Chair of CDC-ECC'05

**Professor Edward J. Davison
University of Toronto**

The Theory-Practice Gap: Where are We?

**Monday, December 12th
8:20 – 9:30
Giralda I**

This talk examines the question: where are we, and where are we going in Control? The talk can be broken into three sections:

The Gap Goes Both Ways: An overview is made of a number of the most successful industrial control systems which exist today, and it will be pointed out that the techniques used to design such control systems are not in our standard tool box of "theory". Here "physics", which plays a key role, is missing! On the other hand, some examples from industry will be given to show that their controller design obtained can completely fail, and what is needed is a dose of "theory" from the toolbox. Thus the gap goes both ways. Industry often says that the tools of "theory" are inadequate – the response to this is that we need to construct "better theory".

Bridging the Gap: Many problems have constraints associated with the output time response of the system, as well of course, control signal magnitude constraints; for example, it is often desired that the output response should not have any over-shoot and should ideally have zero interaction. A new cheap control performance index will be suggested which can deal with such output time response problem constraints. The notion of a "saturation index"(SI) is then discussed which gives a measure of the closed loop system's operating range. In this case, a system with a saturation index of one implies that the controller makes optimal use of the control signal constraints, while a larger SI implies that the system's operating range may be highly restrictive. The application of the new performance index in Model Predictive Control (MPC), which always results in a SI of one, is then discussed. MPC has the significant disadvantage that it can only be used on plants with slower dynamics ... a new MPC algorithm which can be up to 40x faster than standard algorithms will then be illustrated.

New Areas of Research: At all times, we should be alert to new areas of research. A possible new direction "High Dimensional Modeling" will be suggested, which deals with the problem of modeling and simulation of very high dimensional state systems, where the system is nonlinear, very stiff, and dense. For example, in polymer engineering, systems of equations of order $n = 25000$ often arise, and on using a Cray computer, standard stiff integration software hopelessly fails. However, on using the physics of the process and system theory, we can convert the polymer model to a new representation, which allows it to be easily solved using your home computer.



Edward J. Davison received the A.R.C.T. degree in piano in 1958, the B.A.Sc. degree in Engineering-Physics and the M.A. degree in Applied Mathematics from the University of Toronto in 1960, 1961 respectively, and the Ph.D. degree and Sc.D. degree from Cambridge University in 1964 and 1977, respectively. He was appointed as University Professor of Electrical and Computer Engineering at the University of Toronto in 2001, and as University Professor Emeritus in 2004. He was inducted into the University of Toronto's Engineering Alumni Hall of Distinction in 2003. Dr. Davison has received awards including the National Research Council of Canada's E.W.R. Steacie Memorial Fellowship 1974-77, the Canada Council Killam Research Fellowship 1979-80, 1981-83, the Athlone Fellowship (Cambridge

University) 1961-63, two IEEE Transactions on Automatic Control Outstanding Paper Awards, and a Current Contents Classic Paper Citation. He was elected a Fellow of the Canadian Academy of Engineering in 2005, a Fellow of the Institute of Electrical and Electronic Engineers in 1977, a Fellow of the Royal Society of Canada in 1977, an Honorary Professor of Beijing Institute of Aeronautics and Astronautics in 1986, and has been a designated Consulting Engineer of the Province of Ontario since 1979. In 1984, he received the IEEE Centennial Medal and was elected a Distinguished Member of the IEEE Control Systems Society, and in 1996 he received the Outstanding Member Service Award from IFAC. He has served on numerous positions in the IEEE Control Systems Society including President in 1983 and Consulting Editor of the IEEE Trans. on Automatic Control in 1985. He was Chairman of the IFAC Theory Committee in 1988-1990, Vice-Chairman of the IFAC Technical Board in 1990-1993, and a member of the IFAC Council in 1991-1996. He has served on numerous Editorial Boards of various journals. In 1993, he was awarded the triennial Quazza Medal from the International Federation of Automatic Control, in 1997, he received the IEEE Control System Society's Hendrick W. Bode Lecture Prize, and in 2003, he received the Canada Council Killam Prize in Engineering.

Professor Pravin P. Varaiya
University of California at Berkeley

**Bode Lecture: Reducing Highway Congestion:
An Empirical Approach**

Thursday, December 15th
17:00 – 18:00
Giralda I

The California Freeway Performance Measurement System (PeMS) database stores real-time data from 26,000 loop detectors. PeMS extracts useful information from these data and displays it in graphical or tabular form. The data provide an unparalleled opportunity to assess highway performance and discover ways to improve highway management. The talk illustrates this opportunity by suggesting approaches to reduce congestion. The approaches range from bottleneck identification and effective ramp metering to questioning the current operation of high-occupancy vehicle or carpool lanes.



Pravin Varaiya is Nortel Networks Distinguished Professor in the Department of Electrical Engineering and Computer Sciences at the University of California, Berkeley. From 1975 to 1992 he was also Professor of Economics at Berkeley. His research is concerned with transportation, communication networks, and hybrid systems.

Varaiya has held a Guggenheim Fellowship and a Miller Research Professorship. He received an Honorary Doctorate from L'Institut National Polytechnique de Toulouse, and the Field Medal of the IEEE Control Systems Society. He is a Fellow of IEEE and a member of the National Academy of Engineering. He is on the editorial board of several journals, including *"Discrete Event Dynamical Systems and Transportation Research---C"*. He has co-authored three books and more than 250

technical papers. The second edition of *"High-Performance Communication Networks"* (with Jean Walrand) was published by Morgan-Kaufmann in 2000. *"Structure and Interpretation of Signals and Systems"* (with Edward Lee) was published in 2003 by Addison-Wesley.

Professor Dimitri Bertsekas
Massachusetts Institute of Technology

Dynamic Programming and Suboptimal Control: From ADP to MPC

Tuesday, December 13th
8:30 – 9:30
Giralda I

We survey some recent research directions within the field of approximate dynamic programming (ADP), with a particular emphasis on rollout algorithms and model predictive control (MPC). We argue that while motivated by different concerns, these two methodologies are closely connected, and the mathematical essence of their desirable properties (cost improvement and stability, respectively) is couched on the central dynamic programming idea of policy iteration. In particular, among other things, we show that the most common MPC schemes can be viewed as rollout algorithms and are related to policy iteration methods. Furthermore, we embed rollout and MPC within a new unifying suboptimal control framework, based on a concept of restricted or constrained structure policies, which contains these schemes as special cases.



Dimitri Bertsekas obtained his doctorate at the Massachusetts Institute of Technology, where he is currently McAfee Professor of Engineering. His research includes optimization, control, large-scale computation, and data communication networks, and is closely tied to his teaching and book authoring activities. He has written numerous research papers in these fields, and he has authored or coauthored thirteen textbooks, including "*Nonlinear Programming*", "*Dynamic Programming*", "*Network Optimization*", "*Neuro-Dynamic Programming*", "*Introduction to Probability*" and "*Convex Analysis and Optimization*" all published within the last ten years. Professor Bertsekas was awarded the INFORMS 1997 Prize for Research Excellence in the Interface Between Operations Research and Computer Science for his book "*Neuro-Dynamic Programming*" (co-authored with John Tsitsiklis), the 2000 Greek National Award for Operations Research, and the 2001

ACC John Ragazzini Education Award. In 2000, he was elected to the United States National Academy of Engineering.

Professor Andreas Stemmer
Swiss Federal Institute of Technology

Control Strategies in Atomic Force Microscopy

Tuesday, December 13th
8:30 – 9:30
Santa Cruz

Atomic force microscopes provide unprecedented access to surfaces at the nanometer level both for imaging and for local surface modifications. Precise positioning, accurate control of interaction forces, and speed are critical issues when operating these instruments. This lecture summarizes how modern model-based control strategies lead to higher permissible imaging speeds, improved control over the interaction forces, and better tracking of surface features compared with conventional proportional-integral-controlled atomic force microscopes. In particular, H_∞ - and l_1 -optimal methods are applied to control both lateral scanning motions and vertical positioning. Various experimental results verify the achieved performance.



Andreas Stemmer holds the Chair of Nanotechnology at the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland, where in 1995 he founded the Nanotechnology Group. Born 1962 in Basel, Switzerland, he studied at the University of Basel where he obtained his diploma in Physics in 1986. He continued his studies in molecular biology at the M.E. Müller Institute of the Biocenter at the University of Basel and received certification from the Swiss Commission for Molecular Biology (SKMB). In 1990 he earned his doctorate in biophysics working on biological scanning tunneling microscopy. After conducting research as visiting scientist (1990-92) at the Medical Research Council Laboratory of Molecular Biology in Cambridge, UK, he was assistant scientist (1992-95) at the Marine Biological Laboratory in Woods Hole, MA, USA. He was elected to the Faculty of Mechanical and Process Engineering at ETH Zurich in 1995 and was promoted to full professor in 2004.

His research focuses on the development of novel tools and processes to create a link as direct as possible between the macro- and the nano-world. His Nanotechnology Group is particularly active in the fields of imaging tools and techniques to expand the limits of scanning probe and light microscopy, and in natural nanofabrication to pattern and assemble nanostructures outside of cleanrooms. Most recently he started a research vector in biological engineering aimed at harvesting electrical energy from living human cells and tissue

Professor Michel Gevers
Université Catholique de Louvain

**Identification for Control: From the Early Achievements
to the Revival of Experiment Design**

Wednesday, December 14th
8:30 – 9:30
Giralda I

This lecture presents the author's views on the development of identification for control. The lecture reviews the emergence of this subject as a specific topic over the last 15 years, at the boundary between system identification and robust control. It shows how the early focus on identification of control-oriented nominal models has progressively shifted towards the design of control-oriented uncertainty sets. This recent trend has given rise to an important revival of interest in experiment design issues in system identification. Some recent results on experiment design are presented.



Michel Gevers was born in Antwerp, Belgium, in 1945. He obtained an Electrical Engineering degree from the Université Catholique de Louvain, Belgium, in 1968, and a Ph.D. degree from Stanford University, California, in 1972. He is a Fellow of the IEEE, a Distinguished Member of the IEEE Control Systems Society, and he holds a Honorary Degree (Doctor Honoris Causa) from the University of Brussels. He has been President of the European Union Control Association (EUCA) from 1997 to 1999, and Vice President of the IEEE Control Systems Society in 2000 and 2001. In 2004, he initiated a petition within the IEEE that successfully brought an end to the embargo applied by the IEEE towards its members in Cuba, Iran, Libya and Sudan. Michel Gevers is Professor at the Université Catholique de Louvain in Louvain-la-Neuve, Belgium. He is the coordinator of the Belgian Interuniversity Pole on Dynamical Systems and Control, funded by the Federal Ministry of Science. He has spent long term visits at the University of Newcastle, Australia, the

Technical University of Vienna, and the Australian National University, where he has also held a 3-year position as Senior Research Fellow. His present research interests are in system identification and its interconnection with robust control.

Michel Gevers has been Associate Editor of *Automatica* and of the *IEEE Transactions on Automatic Control*. He is presently Associate Editor at Large of the *European Journal of Control*, and Associate Editor of *Mathematics of Control, Signals, and Systems*. He has published over 200 papers and conference papers, and two books: "*Adaptive Optimal Control - The Training Man's GPC*", by R.R. Bitmead, M. Gevers and V. Wertz (Prentice Hall, 1990), and "*Parametrizations in Control, Estimation and Filtering Problems: Accuracy Aspects*", by M. Gevers and G. Li (Springer-Verlag, 1993).

Professor Carlos Canudas-de-Wit
Laboratoire d'automatique de Grenoble

Fun-To-Drive By Feedback

Wednesday, December 14th
8:30 – 9:30
Santa Cruz

This lecture is devoted to new challenging control problems arising in the automotive industry as a consequence of the customer-driven performance specifications adopted by car builders which have dramatically increased the number of new proposed automated features where feedback interacts with the driver. The notion of "Fun-to-Drive by Feedback" relates, here, to the ability to design a control scheme resulting in good ride comfort behavior as well as acceptable safe operation. The paper shows how control techniques can be used to solve some of these problems, and discusses how these subjective notions can be formalized thanks to concepts such as passivity and model matching control. The paper presents a series of examples concerning systems that provide assisted automated devices (i.e. electrical power steering and assisted clutch synchronization), as well as systems with fully automated features (i.e. steer-by-wire system, stop-and-go), in which these aspects are assessed. The material of the lecture was prepared in collaboration with the following individuals: Hubert Bechart, Xavier Claeys, Pietro Dolcini, and John-Jairo Martinez. Support from Renault, CNRS, and the ARCOS-program is gratefully acknowledged.



Carlos Canudas-de-Wit was born in Villahermosa, Tabasco, Mexico in 1958. He received his B.Sc. degree in electronics and communications from the Technological Institute of Monterrey, Mexico in 1980. In 1984 he received his M.Sc. in the Department of Automatic Control, Grenoble, France. He was visitor researcher in 1985 at Lund Institute of Technology, Sweden. In 1987 he received his Ph.D. in automatic control from the Polytechnic of Grenoble (Department of Automatic Control), France. Since then he has been working at the same department as Director of research at the National Center for Scientific Research (CNRS), where he teaches and conducts research in the area of nonlinear control of mechanical systems. His research topics include: vehicle control, adaptive control, identification, control of robots, systems with friction, AC and CD drives, and networked controlled systems. His research publications include more than 120 conference papers, and more than 47 published papers in international journals. He has been associate editor

for the IEEE-Transaction on Automatic Control 1992-1997, and for AUTOMATICA 1999-2002.

Monday, December 12th, 16:00 – 18:00

Ecija

Energy Management and Drivability Control of Hybrid-Electric Vehicles

Chair: Rizzoni, Giorgio
Co-Chair: Yurkovich, Stephen
Organizer: Rizzoni, Giorgio

The Ohio State Univ.
The Ohio State Univ.
The Ohio State Univ.

Hybrid electric vehicles (HEV) are beginning to find a strong niche in the market place. Virtually all vehicle OEMs are currently planning the introduction of hybrid-electric models, and there are several vehicles produced by Toyota, Honda, Ford and GM already on the market. Hybrid-electric vehicles, much like conventional vehicles, must satisfy tradeoffs between fuel economy and emissions objectives and performance and driveability objectives. Control plays a key role in meeting these objectives, and the goal of this tutorial session is to present an overview of current control problems that are specifically associated with energy management and driveability control of HEVs. The organization of this Tutorial Session reflects the above considerations. The content of the session reflects a cross section of important control problems related to hybrid vehicle control systems, and the four speakers will cover topics ranging from an industry perspective to the formulation (and some proposed solutions) to energy management and driveability control, as well as to the need for specialized graduate education in this area.

Tuesday, December 13th, 10:00 – 12:00

Estepa

Molecular Systems Biology and Control

Chair: Khammash, Mustafa H.
Co-Chair: Iglesias, Pablo A.
Organizer: Sontag, Eduardo D.

Univ. of California at Santa Barbara
Johns Hopkins Univ.
Rutgers Univ.

This mini-tutorial provides an introduction to some aspects of the field of molecular systems biology, whose ultimate goal is the unraveling of the basic dynamic processes, feedback control loops, and signal processing mechanisms underlying life. Leading biologists have recognized that new systems-level knowledge is urgently required in order to conceptualize and organize the revolutionary developments taking place in the biological sciences, and the time may be ripe for our community to usefully contribute to this endeavor.

The session will be organized as follows. Sontag's lead presentation provides a brief introduction to some of the main molecular biology concepts and terminology, argues that cells must be viewed as dynamical systems, and discusses in general terms systems-theoretic opportunities and challenges afforded by the field. The presentation by Khammash and El-Samad focuses on comparisons between stochastic and deterministic modeling frameworks, which is a delicate issue in systems that involve relatively small numbers of molecules. The presentation by Iglesias deals with chemotaxis, the problem of movement of cells in response to chemical gradients, and one of the best studied questions in the field. The session will close with a 20-minute question and answer period.

Tuesday, December 13th, 16:00 – 18:00

Giralda V

Airspace De-Confliction

Chair: Parthasarathy, Sanjay
Co-Chair: Jackson, Mike R. C.
Organizer: Parthasarathy, Sanjay
Organizer: Samad, Tariq

Honeywell Tech. Center
Honeywell Aerospace Electronic Systems
Honeywell Tech. Center
Honeywell Lab.

The tutorial session on airspace de-confliction will illustrate technology advancements and implementations that increase aircraft safety in shared airspace. Key civilian and military applications will be highlighted, and applicability to both manned and unmanned vehicles will be discussed.

Airspace de-confliction is both a system-level problem addressed via ground-based command centers focused on airspace capacity and system safety; as well as a sub-system problem addressed via on-board avionics focused on aircraft safety and economical operations. This tutorial session will bring together academic and industrial participants, and illustrate their success in solving key technical challenges in airspace de-confliction via ground-based and on-board solutions. Emphasis will be placed on decentralized approaches running on individual aircraft avionic systems. This will complement ground-based Air Traffic Control, with shared responsibility for safe flight under all operational conditions.

Wednesday, December 14th, 10:00 – 12:00

Giralda II

Sensor Networks and Cooperative Control

Chair: Cassandras, Christos G.

Boston Univ.

Co-Chair: Bullo, Francesco

Univ. of California at Santa Barbara

Organizer: Cassandras, Christos G.

Boston Univ.

This tutorial session will consist of three presentations by C.G. Cassandras (Boston University), Francesco Bullo (University of California, Santa Barbara), and P.R. Kumar (University of Illinois, Urbana-Champaign), followed by a question-answer and open discussion period.

The purpose of the session is to introduce the overall framework of sensor networks viewing them as dynamic systems, explain what makes them different from conventional communication networks, and describe some of the most basic, but also unique, problems involved that are currently the subject of research, such as energy-minimizing deployment and coverage control under communication constraints. An important element to be discussed is the difference between centralized and distributed control approaches and why in sensor networks the latter become essential. Focusing on mobile sensor networks, we will offer a comprehensive overview of cooperative control as it applies to motion coordination. Models of multi-agent networks will be presented, along with representative algorithms for basic tasks such as deployment and rendezvous. We will also discuss the use of mobility in executing complex missions such as searching for data sources, visiting them, and tracking them if they are themselves mobile. A broader objective of the session is to address the theme of convergence of control with communication and computation, and in particular means for facilitating its proliferation. The issues to be discussed include appropriate architecture and abstractions for control over networks, appropriate services for middleware, and challenging theories that are necessary to successfully bring about this convergence.

Wednesday, December 14th, 16:00 – 17:40

Giralda I

Hybrid Control of Networked Embedded Systems

Chair: Lamnabhi-Lagarrigue, Françoise

CNRS

Co-Chair: Lygeros, John

Univ. of Patras

Organizer: Lamnabhi-Lagarrigue, Françoise

CNRS

The term hybrid systems is used in the literature to refer to systems that feature an interaction between diverse types of dynamics. Most heavily studied in recent years are hybrid systems that involve the interaction between continuous and discrete dynamics. The study of this class of systems has to a large extent been motivated by applications to embedded systems and control. Embedded systems by definition involve the interaction between digital devices and a predominantly analog environment. In addition, much of the design complexity of embedded systems comes from the fact that they have to meet specifications such as hard real-time constraints, scheduling constraints, etc. that involve a mixture of discrete and continuous requirements. Therefore, both the model and the specifications of embedded systems can naturally be expressed in the context of hybrid systems. Control problems have been at the forefront of hybrid systems research from the very beginning. The reason is that many important applications with prominent hybrid dynamics come from the area of embedded control, for example: avionics, automated highways, communication networks, automotive control, air traffic management, industrial process control, manufacturing and robotics. The Network of Excellence HYCON (www.ist-hycon.org) aims to consolidate and promote research on hybrid control. In addition to research integration, the activities of HYCON include collaborative efforts in the teaching of hybrid systems, the establishment of a hybrid systems tool repository, and the establishment of common benchmarks on which to test novel hybrid systems methods. The objective of this tutorial session is to first overview the main recent research advances and highlight some of the timely open problems and then to propose techniques and describe some of the main challenges in the four application domains studied by the HYCON consortium: Energy Management; Industrial Controllers; Automotive Electronics Design; and Communications Systems.



Monday, December 12th, 18:15 to 19:15

Santa Cruz

An Industrial View on the Areas for Future Controls Research

Organizers: Mike Grimble and Reza Katebi

University of Strathclyde

Panel (provisional):

Alkis Konstantellos

EU Programme Officer

Chris Elston

RWEnpower

Matt MacDonald

SELEX-SAS

Andy Scarisbrick

Ford, UK

Chris Fryer

Alstom

Ron Patton

Hull

Abstract: The theory and application of control engineering has rapidly expanded in the last decade due to reduction in the cost of computing, sensing and communication technology. This has led to the application of control theory in many new fields where control systems has played an important role in improving the process performance in areas such as manufacturing, food technology, environment, transportation, computers and networks. The rapid advancement of control theory and technology in these new areas has also highlighted the need for extension of basic control theory and tools and possible advent of new methods and techniques to deal with increasingly complex and uncertain systems.

The objective of this panel is to discuss some of the prospects for control research from an industrial point of view and to explore the possible new areas of control research. The panel discussion is intended to help to bring together the academic and industrial view points on the direction of control research over the next decade and to identify the control tools and training which may be required by industry to facilitate the useful application of control theory.

Tuesday, December 13th, 18:15 to 19:15

Santa Cruz

Control Aspects of the Cassini / Huygens – Mission to Explore the Saturnian System

Organizer: Klaus Schilling

University Wuerzburg

Abstract: In July 2004, after a journey of 7 years the Cassini/Huygens-spacecraft of NASA/ESA arrived at Saturn, and since then is delivering interesting images and measurements from Saturn, its rings and its more than 30 moons. On January 14, 2005 the descent probe "Huygens", built by European industry, entered the atmosphere of Titan, the largest moon of Saturn, and very successfully explored its amazing atmosphere, in which the existence of organic molecules had been proven earlier.

To transfer a spacecraft with a launch mass of almost 6t to Saturnis was beyond the available launcher capacity, thus a very elaborate interplanetary trajectory had to be designed, including gravity-assisted flybys. After arrival in the Saturnian system further flybys at Titan are used to modify the Cassini orbit for the most appropriate observations of the Saturnian moons.

The atmosphere of Titan was only poorly known when this mission was designed; therefore the descent of the Huygens Probe raised interesting technology challenges for autonomous reaction capabilities. As the signals require 67 Minutes to travel the distance between Titan and Earth, several versions of the on-board data processing systems were considered, in order to autonomously control the parachute descent system to land on the surface of Titan in time.

The panel addresses the challenging technology approaches to enable this mission, with emphasis on control and navigation tasks. Recent fascinating images from this remote, bizarre world of Titan: with rivers and lakes made of Methane will be presented.

Monday, December 12th, 12:15 to 13:15

Giralda I

How Do Control System Design Engineers Use Models and Simulation?

Pieter J. Mosterman
Corporate Communications, The MathWorks

In control system design, we typically model the plant in detail and then make the model amenable to control law synthesis. With this law at its core, the controller model is gradually refined with implementation detail. Physical models are combined with computational models to ensure we can realize the design. At present, computational modeling increasingly replaces physical modeling. This requires sophisticated modeling formalisms and tools. For example, in plant modeling, domain specific languages for, e.g., multi-body systems and image processing systems as well as extensive tool infrastructure, are needed.

The challenges we face to further this trend are (i) providing domain-specific modeling formalisms, (ii) providing tool support, (iii) combining different formalisms, and (iv) automatic model translation.

We discuss the role of models in control system design and address questions such as: Is there a set of sufficient semantic notions for our modeling languages or a general 'computing API' to combine different formalisms? Is simulation a sufficiently powerful technology? What is the best approach to generating modeling formalisms (libraries, meta-modeling, API, other)? Is there an optimal formalism to translate between formalisms? Can we derive denotational or operational models from axiomatic specifications (i.e., generate models from 'scenarios')? How about producing target specific code? How can style guidelines be enforced and is there a need to configure tools for controller design? How about support for enterprise-wide modeling? Can model reduction techniques handle industrial models for control synthesis? How can you guarantee model composability? How can we obtain explicit models (e.g., hybrid automata) from models in a more practicable representation?

Registration**Sunday–Friday, December 11–16**

All conference attendees must register. Personal badges will be provided to identify registered participants. All registered participants will receive a CD-ROM containing the conference proceedings. A reduced registration rate is available for students, retirees, and life members. Full registration also includes the Conference Banquet on Wednesday, December 14.

Registration Desk Hours		
Saturday	December 10	18:00 – 20:00
Sunday	December 11	10:00 – 12:00
Sunday	December 11	15:00 – 17:30
Monday	December 12	8:00 – 17:30
Tuesday	December 13	8:00 – 17:30
Wednesday	December 14	8:00 – 17:30
Thursday	December 15	8:00 – 15:00

Conference Proceedings

The CD-ROM containing the conference proceedings will be distributed at the conference registration desk along with the registration package. A limited number of additional CD-ROMs will be available for purchase at the conference.

Welcome Reception**Sunday, December 11****Grand Hall****20:00– 22:00**

All conference attendees and their accompanying guests are invited to attend the Welcome Cocktail. Invitations can be found in the registration pack.

Companion Orientation**Monday Dec 12****Bar Corona****11.00–12.00**

A get-together for companions of conference attendees will be held, and information on activities and local attractions will be provided.

Students/Newcomers Reception**Monday Dec 12****Terrace Room****19.00–20.00**

An informal get-together for students and CDC and ECC newcomers to socialize, make new friends and meet some of the award winners and officers of the Control Systems Society and EUCA. Refreshments and snacks will be available.

Awards Ceremony and Reception**Wednesday, December 14****Torreón de la Juliana****19:30 – 21:00**

At the ceremony, award winners both from the Control Systems Society and the IEEE will be honored for their exceptional and outstanding contributions. A brief reception will follow the ceremony. The ceremony location is situated 12 Kms outside Seville. A complimentary bus service will be provided to take attendees to the Award Ceremony location and back. Buses will leave the venue hotel (Meliá Sevilla) at 18:45 and will return at 21:00 (for those attendees who do not have a banquet ticket).

Conference Banquet**Wednesday, December 14****Torreón de la Juliana****21:00 – 23:00**

One banquet ticket will be provided in each registration pack (except for reduced-registration attendees). Additional tickets may be pre-ordered through the advance registration process or purchased on-site. Please notice that this location is situated 12 Kms outside Seville. A complimentary bus service will be provided to take attendees to the banquet location and back. The first buses will leave the venue hotel (Meliá Sevilla) at 19:30 and return after the banquet (23:00 onwards). A cocktail will be served before the banquet from 20:30.

Farewell Reception**Thursday, December 15****Grand Hall****18:30 – 20:30**

All attendees and their accompanying guests are invited to attend, unwind, say good-bye to friends, and make plans for the next ECC and CDC. Drinks and food will be provided at the cocktail.

Conference Exhibits**Monday – Wednesday, December 12–14: 9:00 – 17:00****Hall level -2****Thursday, December 15: 9:00 – 13:00**

A number of exhibitors will participate, including Scilab Consortium, National Instruments, Princeton University Press, Springer and SIAM: Society for Industrial and Applied Mathematics.

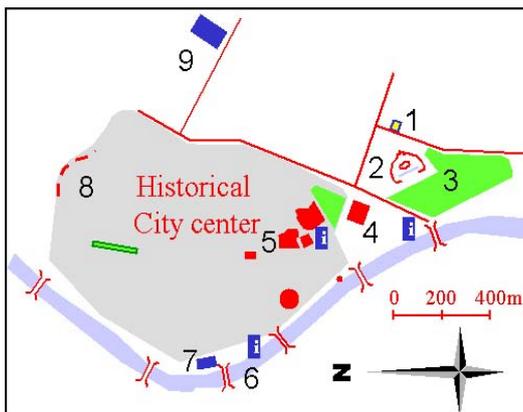
Travel to Seville:

- Train: From Madrid by the AVE train (2h30min). For more information visit the RENFE Spanish railroads site. <http://www.renfe.es/>
- Airplane: The airport of Seville ("San Pablo" SVQ) has connections with many European cities. Consult the site of AENA (Spanish airports) (<http://www.aena.es>) and of Iberia (main Spanish airline) (<http://www.iberia.es>).
- Car: From Madrid via N-IV (south), From Jerez via N-IV (north), From Malaga via A-92 (west) (see maps)

Getting to the venue Hotel (HOTEL MELIA SEVILLA, <http://www.meliasevilla.solmelia.com/>) from the airport:

Taxi: The fare of a taxi from the airport to any point in Seville (and viceversa) is 18 € on week days and 21 € at night (after 22:00), Saturdays, Sundays or festivities. The trip to the hotel Melia Sevilla should take around 20 minutes.

Buses: There is a bus service that will take you from the airport to the center of Seville and runs every 30 minutes except for off peak hours (time table and stops: http://www.tussam.es/horarios/pdf/LINEA_AEROPUERTO.pdf). There is a reduced service on Saturdays, Sundays or festivities. The price of the ticket is 2.30 €. Nearest stop (5 minute walk) coming from the airport is "Carlos V: Diego de Riaño". Pick up for return trip to airport from a stop directly in front of the hotel ("Dr. Pedro de Castro").



- 1 Hotel Melia
- 2 Plaza de España
- 3 María Luisa Park
- 4 Faculty of Law
- 5 Cathedral
- 6 Guadalquivir River
- 7 Bus Station (Plaza de Armas)
- 8 Macarena
- 9 Train Station (Santa Justa)

Tourist offices:

Seville Town Hall: <http://www.sevilla.org/>
 Sevilla tourism: <http://www.turismosevilla.org/>
 Andalusia Tourism: <http://www.andalucia.org/>

Services

Seville Public Transport (buses): <http://www.tussam.es/>

Tour guides

Lanetro Sevilla: <http://sevilla.lanetro.es/>
 Sevilla 5: <http://www.sevilla5.com/>
 Sevilla Online: <http://www.sevillaonline.com/>
 SOL: <http://www.sol.com/>

Weather

The normal daily temperature range for Seville in December is 13 degrees Celsius (55 F) maximum and 4 degrees Celsius (40 F) minimum. The rainy season usually begins in October lasting through December. In this month the average rainfall is 76 mm. (3.0 inches) although last December (2004) was practically dry.

Seville time zone

Sunrise (during conference days): 08h30. Sunset (during conference days): 18h06
 UTC/GMT Offset Standard time zone: UTC/GMT +1 hour (UTC is Coordinated Universal Time, GMT is Greenwich Mean Time). Time zone abbreviation: CET - Central European Time
 Latitude: 37° 24' North. Longitude: 5° 59' West. Altitude: 7m (23 ft.)

Sightseeing

Within Seville



According to legend, Seville was founded by Hercules and its origins are linked with the Tartessian civilisation. It was called Hispalis under the Romans and Isbiliya with the Moors. The high point in its history was following the discovery of America.

Seville lies on the banks of the Guadalquivir and has one of the largest historical centres in Europe, here you can find the Giralda (the minaret of the old mosque), the cathedral (one of the largest in Christendom), and the **Alcázar** Palace. Part of its treasure includes the Casa de Pilatos, the Town Hall, the **Archive of the Indies** (where the historical records of the discovery of and trade with the American continent are kept), the Fine **Arts Museum** (the second largest picture gallery in Spain), plus many other historical buildings (convents, parish churches and palaces).

It has hosted two international exhibitions (1929 and 1992) and is the administrative capital of Andalusia. Other places to visit are the neighbourhoods of Triana over the river and Santa Cruz, Sierpes street,

the Maestranza bullring, **María Luisa park** and the riverside walks which are all representative of Seville.

As well as all its important monuments and fascinating history, Seville is universally famous for being a lively town. It is the largest town in Southern Spain, the city of Carmen, Don Juan and Figaro and many more operas.

In Seville, you will want to visit the old city, with the **Cathedral** and the Giralda tower at its heart. (You can climb the ramps inside the tower for a magnificent view of the City). Close by is the royal Mudéjar palace known as the **Alcázar** with marvellous gardens, and the **Santa Cruz** quarter, once the home of the Jewish community, a labyrinth of winding, narrow streets, shady flower-filled patios. and picturesque squares, flowered balconies, richly decorated facades.



Recommended tapas bars: Don't miss out on the tapas (a brilliant Seville invention). There are more than a thousand bars where the choice of food, is virtually unlimited, from seafood to ham and salami sausage, from vegetable to cheese. Sevillians often eat this way, moving from bar to bar and trying one dish at a time. In the Santa Cruz quarter, try the following bars: Giralda, Modesto, Las Teresas and Casa Robles. In Triana, El Kiosco de las Flores, Casa Cuesta and Bodeguita Sanlúcar. In Santa Catalina, El Rinconcillo, El Bacalao and Quitapesares (Bar Perejil).

Places to visit outside Seville

Itálica (15 km) a Roman city founded by Scipio Africanus in 206 BC where the Emperor Trajan was born. You can visit a well preserved amphitheater and the remains of the streets and houses.

Carmona (30 km) a pleasant Andalusian town with Roman city walls, a Moorish castle (now a Parador), an important Roman Necropolis and many churches.



Jérez (70 km) is famous throughout the world for its wines, named after the town, which the British pronounce "sherry". Jerez is also famous for its fine horses and singers and dancers of flamenco. The distinctive wine in Jerez has been exported for centuries, it was even praised by Shakespeare. It is distinctive because the strong sun gives the grapes a high sugar content. The Spanish word bodega means "cellar", but it has the general meaning of "wine manufacturer". You can take a guided tour of many Jerez bodegas.



Doñana National Park, (80km) one of Europe's most important wetland areas, and home to an incredible multitude of wildlife in its sand dunes, marshes, pine woods, salt flats and freshwater lagoons. Here is one of Europe's last remaining habitats for the endangered lynx and the rare Spanish Imperial Eagle. The best time to visit is in winter and spring when the park is full of wildfowl. In winter, thousands of geese and ducks arrive from the north, while in spring there are many flocks of breeding birds, including herons, spoonbills and storks.

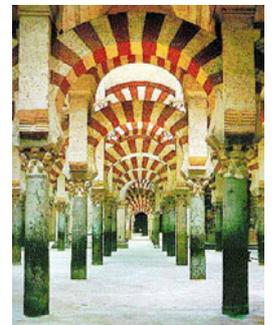


Monasterio de **la Rábida** (80 km) is where **Columbus** stayed between 1491-92 waiting for financial backing from the Catholic Monarchs, Ferdinand and Isabella, for his voyage to the New World. The monastery was constructed in 1412 on the site of a Moorish stronghold; 'rábida' is an Arabic word meaning fortress. The Moorish influence can still be seen in its Mudéjar architecture including a fine cloister. The monastery has a

14th-century Gothic-Mudéjar church where Captain Martín Alonso Pinzón who sailed with Columbus in one of his ships is buried.



Córdoba (150 km) was founded by the Romans and as the highest navigable point of the Guadalquivir River, it became a port city of great importance, used for shipping Spanish olive oil, wine and wheat back to Ancient Rome. The Romans built the mighty bridge crossing the river, now called "El Puente Romano". However, the peak of Córdoba's glory was when it became the capital of the Moorish kingdom of El-Andalus, this was when work began on the Great Mosque, or "Mezquita", which became one of the largest in all of Islam. As well as the unique mosque-cathedral, Córdoba's treasures include the Alcázar, or Fortress, built by the Christians in 1328; the Calahorra Fort, originally built by the Arabs, which guards the Roman Bridge, on the other side of the river from the Mezquita, and the ancient Jewish Synagogue, now a museum. Córdoba's medieval quarter, once the home of the Jewish community, is called "La Judería" (The Jewry), a labyrinth of winding, narrow streets, shady flower-filled courtyards and picturesque squares. The famous moorish palace Medina Azahara just north west of Córdoba can also be visited.



Cádiz (150 km) stands on a peninsula jutting out into a bay, and is almost entirely surrounded by water. Named Gadir by the Phoenicians, who founded their trading post in 1100 BC, it was later controlled by the Carthaginians, until it became a thriving Roman port. It attained great splendour in the early 16th century as a launching point for the journeys to America. Cadiz was later raided by Sir Francis Drake, in the struggle to gain control of trade with the New World, and managed to withstand a siege by Napoleon's army. In the early 19th century Cadiz became the bastion of Spain's anti-monarchist, liberal movement, as a result of which the country's first Constitution was declared here in 1812. Some of the city's 18th century walls still stand. Worth a visit are the city's Cathedral and churches of Santa Cruz and San Felipe Neri, which is famous throughout Spain as the place where, in defiance of Napoleon's siege, the provisional government was set up with its own liberal Constitution. Other points of interest are La Santa Cueva, home to several paintings by Goya.



Granada (230 km) is dominated by the Alhambra, arguably the most exciting, sensual and romantic of all European monuments. It was the palace-fortress of the Nasrid Sultans, rulers of the last Spanish Moorish kingdom and in its construction Moorish art reached a spectacular and serene climax set against the marvelous background of the Sierra Nevada, snowcapped for much of the year. Sierra Nevada offers skiing from November until late May. During the rest of the year the Sierra Nevada National park offers the walker endless hiking opportunities.



Awards Ceremony and Reception
Wednesday, December 14
19:30 – 21:00
Torreón de la Juliana

At the Awards Ceremony, we will be recognizing colleagues for exceptional contributions. The list of the 2004 awards that will be presented is given below together with a brief description of each award. You are invited to submit nominations for the 2005 awards. Details including deadlines and nomination forms may be found at <http://www.ieeecss.org/awards/AWARDSindex.html>

Outstanding Chapter Award

For an outstanding Chapter of the CSS based on the level of its activities and innovations in promoting new activities and services.

CSS Distinguished Member Award

To recognize significant technical contributions and outstanding long-term service to the CSS by an individual who has been a member of the CSS for at least five years.

CDC and CCA Best Student-Paper Awards

To recognize excellence in a paper presented at the Conference on Decision and Control or at the Conference on Control Applications, whose primary author is a Student Member of the IEEE.

CSM Outstanding Paper Award

For an outstanding article or column published in the IEEE Control Systems Magazine during the two calendar years preceding the year of the award, based on impact on and benefit to CSS members.

TCST Outstanding Paper Award

For an outstanding paper published in the IEEE Transactions on Control Systems Technology during the two calendar years preceding the year of the award, based on originality, relevance of the application, clarity of exposition, and demonstrated impact on control systems technology.

George S. Axelby Outstanding Paper Award

For outstanding papers published in the IEEE Transactions on Automatic Control during the two calendar years preceding the year of the award, based on originality, clarity, potential impact on the theoretical foundations of control, and practical significance in applications.

Control Systems Technology Award

To recognize outstanding contributions to control systems technology either in design and implementation, or in project management. This award may be conferred on an individual or a team.

Hendrik W. Bode Lecture Prize

To recognize distinguished contributions to control systems science or engineering. The recipient gives a plenary lecture at the Conference on Decision and Control, evaluating a significant contribution to control systems science or engineering.

IEEE Fellow Award

For outstanding contributions to the electrical and electronics engineering profession.

Control Systems Technical Field Award

For outstanding contributions to control systems engineering, science or technology.

Judith A. Resnik Technical Field Award

For outstanding contributions to space engineering within the fields of interest of the IEEE.

Workshop FD-1 (Full-Day)

Sunday, December 11th, 8:30– 17:30

Control, Estimation, and Optimization of Interconnected Systems: From Theory to Industrial Applications

Organizers: Mihailo R. Jovanović, University of Minnesota
Cédric Langbort, California Institute of Technology

Participants: Bassam Bamieh, University of California at Santa Barbara
Raffaello D'Andrea, Cornell University
Geir Dullerud, University of Illinois at Urbana-Champaign
Dimitry Gorinevsky, Honeywell Laboratories/Stanford University
Sanjay Lall, Stanford University
Fernando Paganini, University of California at Los Angeles
Greg Stewart, Honeywell/University of British Columbia

Target audience

The workshop is aimed at a broad audience of students, researchers, and industry professionals within the control community.

Summary

Large networks of interconnected dynamical systems are becoming prevalent in modern technological applications, as exemplified by the development of cross-directional control systems for paper machines, power distribution systems, automated highways, formations of unmanned aerial vehicles, and arrays of micro-cantilevers for massively parallel data storage, to name just a few. These applications are also of theoretical interest because they pose new challenges for analysis and control design.

Workshop FD-4 (Full-Day)

Sunday, December 11th, 8:30– 17:30

Discrete-time Nonlinear Control Systems

Organizers: Eduardo Aranda-Bricaire, CINVESTAV, México

Participants: Claude Moog, IRCCyN, France
Ülle Kotta, Tallinn University of Technology, Estonia

Summary

Discrete-time systems arise in technology and applied mathematics in different ways. The study of such systems possesses interest both from theoretical and practical points of view. The workshop will present a sound theoretical framework which allows solving a broad class of control problems, e.g. feedback linearization, disturbance decoupling, control by output feedback, observer design, identification, realization, etc. Such framework is provided by the notions of differential forms and exterior differential systems. The workshop is based on a series of papers published by the organizers and coworkers over the past 12 years. It relates also to the difference algebraic framework originally introduced by Fliess.

Workshop FD-5 (Full-Day)

Sunday, December 11th, 8:30– 17:30

Fault Detection and Diagnosis Based on Explicit Models and on Principal Components

Organizers: Janos Gertler, George Mason University, USA
S. Joe Qin, University of Texas, Austin, USA

Summary

The detection and diagnosis of faults (malfunctions) in engineering systems is of paramount importance in modern technology. While limit checking is the classical approach in industry, utilizing a mathematical model of the plant allows for consistency checks. Such checks lead to residuals that are much more sensitive and specific to faults. Consistency checks have been developed in the control and aerospace community using explicit plant models (analytical redundancy). A great wealth of know-how has been accumulated in this framework, including methods of disturbance decoupling, statistical testing and residual enhancement for fault isolation. In the chemical and process industries, principal component analysis has been the method of choice. Principal components lead to an implicit model with a significantly reduced dimension. Principal component models also lead to residuals that have fundamentally the same properties and may be subjected to the same treatment as analytical redundancy residuals.

Workshop FD-7 (Full-Day)

Sunday, December 11th, 8:30– 17:30

Model Predictive Control of Hybrid Systems

Organizers: Alberto Bemporad, University of Siena, Italy
Participants: Nicolò Giorgetti, University of Siena, Italy
 Stefano Di Cairano, University of Siena, Italy

Target audience

The workshop is intended for researchers and engineers that want to learn about the theory and practice of model predictive control (MPC) for linear and hybrid systems, from the basic MPC setup to advanced hybrid modeling and explicit representations of MPC in piecewise affine form via multiparametric programming.

Summary

Most of the control synthesis approaches developed in the last few years for hybrid systems involve the solution of optimal control problems. For continuous-time hybrid systems, researchers either studied necessary conditions for a trajectory to be optimal, or focused on the computation of optimal/suboptimal solutions by means of dynamic programming or the maximum principle. The hybrid optimal control problem becomes less complex when the dynamics is expressed in discrete-time or as discrete-events, as in general the main source of complexity becomes the combinatorial (yet finite) number of possible switching sequences. By looking at the MPC problem as a multiparametric program where the control inputs are the optimization variables and the states and references are the parameters, the equivalent explicit form of the MPC control law can be computed algorithmically. Such a control law is piecewise affine, and consequently, MPC can be implemented as a look-up table of linear gains, drastically easing on-line computations and making the control code much simpler because no numerical optimization solver is involved.

During the workshop, the attendee will be introduced to a free software tool, the Hybrid Toolbox developed by the workshop's proposers [30], which enables a direct application in Matlab of the techniques for modeling, simulating, and verifying the safety properties of hybrid systems, for designing MPC controllers for linear systems with constraints and hybrid systems, and for determining equivalent piecewise affine control functions that can be immediately prototyped on hardware. During the workshop a few case studies will be described that were performed in collaboration with Ford Research Laboratories (Dearborn, MI), to provide an industrial viewpoint and highlight the potentials and limitations on the proposed hybrid MPC technologies.

Workshop FD-8 (Full-Day)

Sunday, December 11th, 8:30– 17:30

The Behavioral Approach to Systems and Control: Introduction and Recent Advances

Organizers: Jan Willem Polderman, University of Twente, the Netherlands
 Harry L. Trentelman, University of Groningen, the Netherlands
Participants: Paula Rocha, University of Aveiro, Portugal
 Eva Zerz, University of Kassel, Germany
 Jan Willems, Catholic University of Leuven, Belgium

Summary

Behavioral models are well suited to treat physical models where the signal flow direction implied by the usual input/output setting is awkward and physically artificial. For instance in interconnected systems input-to-output interconnection is seldom the way physical systems interact, witness the force equality implied in interconnection of mechanical components. Furthermore the behavioral framework is very convenient for studying dynamical systems as composed of smaller subsystems. Other areas where the behavioral approach has proven its suitability is in coding theory, and in composition of Discrete Event Systems through shared variables.

The aim of the workshop is twofold. Firstly, to present a self-contained introduction to the behavioral theory of systems. Secondly, to provide some of the recent advances in the behavioral approach. The introductory part covers the behavioral theory of linear systems. The second part is devoted to systems described by partial differential equations and to dissipative systems. The audience that we have in mind are graduate students, researchers, and senior scientists.

Workshop FD-9 (Full-Day)

Sunday, December 11th, 8:30– 17:30

New Developments in Control Performance Limitation Research: A Tale in the Network Age

Organizers: A. Pedro Aguiar, University of California, USA
 Jie Chen, University of California, USA
 Rick Middleton, University of Newcastle, Australia
 Li Qiu, Univ. of Science and Technology, Hong Kong, P.R. China

Participants: Andrzej Banaszuk, United Technology Research Center, Munzer Dahleh (MIT), James S. Freudenberg (Univ. of Michigan), Nicola Elia (Iowa State University), Graham C. Goodwin (Univ. of Newcastle), Shinji Hara (Univ. of Tokyo), Joao Hespanha (Univ. of California, Santa Barbara), Iven Mareels (Univ. of Melbourne) and Sanjoy Mitter (MIT).

Summary

The workshop addresses constraints, limitations, and tradeoffs in feedback control design and implementation. The proposal is motivated by recent intense activity in this fundamental area of research and its broad applications to control over communication networks, nonlinear control, and control applications. The workshop will bring together leading researchers to make tutorial presentations on emerging problems and new results, with an emphasis placed on control over communication networks and nonlinear tracking illustrated by significant applications. We believe that the theme and the topics to be presented in the workshop are of major interest and will attract a wide audience.

Workshop HD-3 (Half-Day)

Sunday, December 11th, 08:30– 12:30

Identification of Hybrid Systems

Organizers: Aleksandar Juloski, Eindhoven University of Technology
 Giancarlo Ferrari-Trecate, Politecnico di Milan, Italy

Participants: Rene Vidal, Johns Hopkins University, USA
 Simone Paoletti, University of Siena, Italy

Target audience

The workshop is thought for graduate students and researchers with a background in the fields of hybrid systems or system identification. The material covered at the workshop will present state of the art in hybrid identification as well as open research problems in this area. The workshop will also focus on several practical case studies and a discussion on merits and drawbacks of the presented methods. This may be of interest to researchers in other areas and practitioners who want to use identification techniques to obtain hybrid models in practical applications. A minimal prior knowledge in the fields of linear identification and hybrid systems is assumed.

Summary

Due to their ubiquity and many potential applications, hybrid systems attracted a lot of attention in the control community during the last few years. Numerous results on modelling, analysis, verification and control synthesis appeared in the literature. However, most of the theoretical developments hinge on the assumption that the accurate quantitative hybrid model of the process at hand is readily available. In some situations it is possible to obtain such a model starting from first principles. However, in most practical situations first principles modelling is too complicated or even impossible to use, and the model needs to be identified on the basis of experimental data. Methods geared specifically towards the identification of models with a hybrid structure are of very recent date, and to date, several methods exist which have been successfully applied in practical situations. This workshop will focus on the following ones: a) Clustering-based algorithms, b) Bounded error algorithms, c) Bayesian algorithms, and d) Algebraic algorithms. The comparison and several practical applications will be also presented.

The European Control Conference (ECC) is organised every two years under the auspices of the European Union Control Association (EUCA) and aims to stimulate contacts between specialists active in academic research and industrial developments in the area of systems and control and to promote scientific exchanges within the European Community and between Europe and other parts of the world.

Below is the complete list of past ECCs with titles, chairs and locations. In the listing, GC denotes General Chair, PC stands for Program Chair.

European Control Conference, ECC 91

GC: I. D. Landau, PC: D. Normand-Cyrot
Grenoble, France, July 2-5, 1991

European Control Conference, ECC 93

GC: J.C. Willems, PC: J.W. Nieuwenhuis
Gröningen, Netherlands, June 28 - July 1, 1993

European Control Conference, ECC 95

GC: A. Isidori, PC: A. Isidori, S. Bittanti, E. Mosca
Rome, Italy 5-8 September 1995

European Control Conference, ECC 97

GC: G. Bastin, M. Gevers, PC: D. Aeyels, B. De Moor, J. Schoukens
Brussels, Belgium, 1-4 July 1997

European Control Conference, ECC 99

GC: P. M. Frank, PC: P. M. Frank, G. H. Bretthauer
Karlsruhe, Germany, 31. August - 3. September 1999

European Control Conference, ECC 01

GC: J. L. Martins de Carvalho, PC: J. Sá da Costa
Seminário de Vilar, Porto, Portugal, 4-7 September, 2001

European Control Conference, ECC 03

GC: J. Maciejowski, K. Glover, PC: I. Postlewhaite
Cambridge, United Kingdom, 1-4 September, 2003

European Control Conference, ECC 05

GC: E. F. Camacho, PC: R. Tempo
Seville, (Spain), 12-15 December 2005

The annual IEEE Conference on Decision and Control (CDC) is internationally recognized as the premiere scientific and engineering conference dedicated to the advancement of the theory and practice of systems and control. It brings together an international community of experts to discuss the state-of-the-art, new research results, perspectives of future developments, and innovative applications relevant to decision making, control, automation, and related areas.

The CDC is hosted by the IEEE Control Systems Society (CSS), and is organized in cooperation with the Society for Industrial and Applied Mathematics (SIAM), the Institute for Operations Research and the Management Sciences (INFORMS), the Japanese Society for Instrument and Control Engineers (SICE), and the European Union Control Association (EUCA).

Below is the complete list of past CDCs with titles, chairs and locations. The proceedings of all past conferences can be found at the IEEE Library, 345 47th Street, New York, NY 10017.

DISCRETE ADAPTIVE PROCESSES – SYMPOSIUM AND PANEL DISCUSSION (IEEE); part of 3rd JACC

GC: J. Sklansky

New York University, New York City, NY, 29 June 1962

SYMPOSIUM ON ADAPTIVE PROCESSES; part of NEC

GC: L. Kanal

McCormick Place, Chicago, IL, 28-29 October 1963

SYMPOSIUM ON ADAPTIVE PROCESSES; part of NEC

GC: F. J. Mullin

McCormick Place, Chicago, IL, 19-21 October 1964

SYMPOSIUM ON ADAPTIVE PROCESSES; part of NEC

GC: E. C. Jones, Jr., PC: G. Brown

McCormick Place, Chicago, IL, 25-27 October 1965

SYMPOSIUM ON ADAPTIVE PROCESSES; part of NEC

GC: F. N. Bailey, PC: J. C. Hancock

McCormick Place, Chicago, IL, 3-5 October 1966

SYMPOSIUM ON ADAPTIVE PROCESSES; part of NEC

GC: F. M. Waltz, PC: P. E. Mayes

International Amphitheater, Chicago, IL, 23-25 October 1967

IEEE SYMPOSIUM ON ADAPTIVE PROCESSES

GC, PC: J. M. Mendel

UCLA, Los Angeles, CA, 16-18 December 1968

IEEE SYMPOSIUM ON ADAPTIVE PROCESSES

GC: J. B. Lewis, PC: G. J. McMurty

Pennsylvania State University, PA; 17-19 November 1969

1970 SYMPOSIUM ON ADAPTIVE PROCESSES (9th) DECISION AND CONTROL

GC, PC: D. J. Lainiotis

University of Texas at Austin, Austin, TX, 7-9 December 1970

1971 IEEE CONFERENCE ON DECISION AND CONTROL including the 10th SYMPOSIUM ON ADAPTIVE PROCESSES

GC: J. T. Tou, PC: S. K. Mitter, SC: J. M. Mendel

Americana Hotel, Miami Beach, FL, 15-17 December 1971

1972 IEEE CONFERENCE ON DECISION AND CONTROL including the 11th SYMPOSIUM ON ADAPTIVE PROCESSES

GC: J. M. Mendel, PC: Y. C. Ho, SC: G. N. Saridis

Fontainebleau Motor Hotel, New Orleans, LA; 13-15 December 1972

1973 IEEE CONFERENCE ON DECISION AND CONTROL including the 12th SYMPOSIUM ON ADAPTIVE PROCESSES

GC: J. S. Meditch, PC: D. G. Luenberger, SC: L. A. Gerhardt

Sheraton-Harbor Island Hotel, San Diego, CA; 5-7 December 1973

1974 IEEE CONFERENCE ON DECISION AND CONTROL including the 13th SYMPOSIUM ON ADAPTIVE PROCESSES

GC: Elliot Axelband, PC: Stephen Kahne, SC: David P. Lindorff
Del Webb's Towne House, Phoenix, AZ; 20-22 November 1974

1975 IEEE CONFERENCE ON DECISION AND CONTROL including the 14th SYMPOSIUM ON ADAPTIVE PROCESSES

GC: J. B. Cruz, Jr., PC: J. B. Pearson, SC: G. Stein
Hyatt Regency Houston, Houston, TX, 10-12 December 1975

1976 IEEE CONFERENCE ON DECISION AND CONTROL including the 15th SYMPOSIUM ON ADAPTIVE PROCESSES

GC: M. Athans, PC: E. R. Barnes, SC: T. Pavlidis
Sheraton-Sand Key Hotel, Clearwater, FL, 1-3 December 1976

1977 IEEE CONFERENCE ON DECISION AND CONTROL including the 16th SYMPOSIUM ON ADAPTIVE PROCESSES

GC: K. S. Fu, PC: H. Sorenson, SC: T. Pavlidis
Fairmont Hotel, New Orleans, LA, 7-9 December 1977

1978 IEEE CONFERENCE ON DECISION AND CONTROL including the 17th SYMPOSIUM ON ADAPTIVE PROCESSES

GC: Robert E. Larson, PC: Alan S. Willsky, SC: Jerry M. Mendel
Islandia Hyatt House Hotel, San Diego, CA, 10-12 January 1979

18th IEEE CONFERENCE ON DECISION AND CONTROL including the SYMPOSIUM ON ADAPTIVE PROCESSES

GC: Stephen Kahne, PC: Alexander H. Levis, SC: Yaakov Bar-Shalom
Galt Ocean Mile Hotel, Ft. Lauderdale, FL, 12-14 December 1979

19th IEEE CONFERENCE ON DECISION AND CONTROL including the SYMPOSIUM ON ADAPTIVE PROCESSES

GC: Pierre R. Belanger, PC: David L. Kleinman, SC: Richard V. Monopoli
The Regent Hotel, Albuquerque, NM; 10-12 December 1980

20th IEEE CONFERENCE ON DECISION AND CONTROL including the SYMPOSIUM ON ADAPTIVE PROCESSES

GC: William R. Perkins, PC: Abraham H. Haddad, SC: Kumpati S. Narendra
Vacation Village Hotel, San Diego, CA; 16-18 December 1981

21st IEEE CONFERENCE ON DECISION AND CONTROL

GC: Alexander H. Levis, PC: William S. Levine
Holiday Inn - International Drive, Orlando, FL, 8-10 December 1982

22nd IEEE CONFERENCE ON DECISION AND CONTROL

GC: James L. Melsa, PC: Steven I. Marcus
Marriott Hotel, San Antonio, TX, 14-16 December 1983

23rd IEEE CONFERENCE ON DECISION AND CONTROL

GC: Abraham H. Haddad, PC: Michael P. Polis
Las Vegas Hilton, Las Vegas, NV, 12-14 December 1984

24th IEEE CONFERENCE ON DECISION AND CONTROL

GC: Gene F. Franklin, PC: Anthony N. Michel
Bonaventure Hotel & Spa, Ft. Lauderdale, FL, 11-13 December 1985

25th IEEE CONFERENCE ON DECISION AND CONTROL

GC: Anthony Ephremides, co-GC: Spyros Tzafestas, PC: H. Vincent Poor
Atheneum Intercontinental Hotel, Athens, GREECE; 10-12 December 1986

26th IEEE CONFERENCE ON DECISION AND CONTROL

GC: William S. Levine, PC: John Baillieul
Westin Century-Plaza Hotel, Los Angeles, CA, 9-11 December 1987

27th IEEE CONFERENCE ON DECISION AND CONTROL

GC: Michael P. Polis, PC: William E. Schmitendorf
Hyatt Regency Austin on Town Lake, Austin, TX, 7-9 December 1988

28th IEEE CONFERENCE ON DECISION AND CONTROL

GC: Leonard Shaw, PC: Tamer Başar
Hyatt Regency Tampa Hotel, Tampa, FL, 13-15 December 1989

29th IEEE CONFERENCE ON DECISION AND CONTROL

GC: Charles J. Herget, PC: Raymond A. DeCarlo
Hilton Hawaiian Village, Honolulu, HI, 5-7 December 1990

30th IEEE CONFERENCE ON DECISION AND CONTROL

GC: Derek Atherton, PC: Panos J. Antsaklis
Metropole Hotel, Brighton, England, 11-13 December 1991

31st IEEE CONFERENCE ON DECISION AND CONTROL

GC: Tamer Başar, PC: Sergio Verdu
Westin La Paloma, Tucson, AZ, 16-18 December 1992

32nd IEEE CONFERENCE ON DECISION AND CONTROL

GC: Raymond A. DeCarlo, PC: Peter Ramadge
Marriott Rivercenter, San Antonio, TX, 15-17 December 1993

33rd IEEE CONFERENCE ON DECISION AND CONTROL

GC: Michael K. Masten, PC: N. Harris McClamroch
Buena Vista Palace, Lake Buena Vista, FL, 14-16 December 1994

34th IEEE CONFERENCE ON DECISION AND CONTROL

GC: Panos J. Antsaklis, PC: Edward W. Kamen
New Orleans Hilton Riverside, New Orleans, LA, 13-15 December 1995

35th IEEE CONFERENCE ON DECISION AND CONTROL

GC: Hidenori Kimura, Co-PCs: Katsuhisa Furuta, J. Douglas Birdwell
Portopia Hotel and International Conference Center, Kobe, Japan, 11-13 December 1996

36th IEEE CONFERENCE ON DECISION AND CONTROL

GC: Anthony Michel, PC: Theodore E. Djaferis
Hyatt Regency San Diego, San Diego, CA, 10-12 December 1997

37th IEEE CONFERENCE ON DECISION AND CONTROL

GC: J. Douglas Birdwell, PC: David Castanon
Hyatt Regency Westshore, Tampa FL, 16-18 December 1998

38th IEEE CONFERENCE ON DECISION AND CONTROL

GC: Edward W. Kamen, PC: Christos Cassandras
Crowne Plaza Hotel and Resort, Phoenix, AZ, 7-10 December 1999

39th IEEE CONFERENCE ON DECISION AND CONTROL

GC: Robert R. Bitmead, PC: Cheryl B. Schrader
Sydney Convention and Exhibition Centre, Sydney, NSW Australia; 12-15 December 2000

40th IEEE CONFERENCE ON DECISION AND CONTROL

GC: Theodore E. Djaferis, PC: Kevin M. Passino
Hyatt Regency Grand Cypress, Orlando, FL, 4-7 December 2001

41st IEEE CONFERENCE ON DECISION AND CONTROL

GC: Ümit Özgüner, PC: Kenneth Loparo
The Venetian Hotel, Las Vegas, NV, 10-13 December 2002

42nd IEEE CONFERENCE ON DECISION AND CONTROL

GC: Frank Lewis, PC: Chaouki Abdallah
Hyatt Regency Resort & Spa, Maui, HI, 9-12 December 2003

43rd IEEE CONFERENCE ON DECISION AND CONTROL

GC: Christos Cassandras, PC: Weibo Gong
The Atlantis, Paradise Island, The Bahamas, 14-17 December 2004

44th IEEE CONFERENCE ON DECISION AND CONTROL

GC: Eduardo F. Camacho, PC: Roberto Tempo
The Meliá Sevilla, Seville, (Spain). 12-15 December 2005

CONFERENCE SPONSORS



CORPORATE SPONSORS



INSTITUTIONAL SUPPORT

