16th IFAC World Congress
Final Report

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Content:

1 Introduction

It was a great pleasure to welcome the participants of the **16th IFAC World Congress held in Prague, Czech Republic, from July 4 to July 8, 2005**. The congresses of IFAC are the most important meetings of the Automatic Control community; they are held triennially and attended by more than 2,000 professionals. The Congress was a great opportunity for presenting new results and directions of Automatic Control theory, technology and applications. As such, it mainly concentrated on the following key points:

- emphasis on invited lectures including plenaries, surveys and tutorials,
- industry participation promotion,
- attracting young people to study and work in the field.

The participants of the 16th IFAC World Congress had the opportunity to take part in the wide spectrum of categories for technical presentations, including plenary lectures, survey papers, regular papers of both lecture and poster session types and panel discussions. Immediately preceding the formal opening of the Congress, tutorials and workshops were offered giving participants an opportunity to learn new principles, methodologies, technologies and applications that have been developed in recent years.

The Congress was a great success in terms of number of submitted contributions and participants. An introduction to Congress statistics provides the following table.

Papers submitted	3284
Papers accepted for the final program *)	2456
Countries contributing to the program	73
Overall attendance	2462
Attendance from academia	2099
Attendance from industry	363
Countries represented by the registration	63

*) The figure includes plenary and semi-plenary papers, reports for panel discussions including so called Milestones, oral presentations and posters combined.

The absolute numbers should be compared to the historical records of preceding IFAC Congresses, Barcelona 2002 and Beijing 1999, to understand how is the field of Automatic Control and related branches evolving. Number of papers presented in Prague Congress was by 679 higher than in Barcelona and by 900 higher than in Beijing six years ago, while the acceptance rate was approximately the same. The Prague's attendance was by 451 higher than in Barcelona and by 996 higher than in Beijing.

2 Contributing Authors

Overall figures regarding authors and co-authors of papers scheduled for the final program gives the table below.

Total number of authors of accepted papers	5162
Average number of authors per an accepted paper	2
Authors of accepted papers from academia	4805
Authors of accepted papers from industry	357
Number of countries contributing to the technical program	73

2.1 Number of authors per country

The following two tables show number of authors contributing to the Congress technical program per country. The first table, table on the left, lists countries in alphabetic order, the second table orders countries according to number of authors in descending order.

Country	Number of contributing authors
Algeria	9
Argentina	20
Armenia	3
Australia	89
Austria	41
Bangladesh	1
Belarus	10
Belgium	66
Bosnia and Herzegovina	3
Brazil	120
Bulgaria	12
Canada	98
Colombia	1
Croatia	4
Cuba	6
Cyprus	2
Czech Republic	140
Denmark	35
Egypt	2
Estonia	9
Finland	89
France	521
Germany	310
Greece	58
Hong Kong	37
Hungary	49

Country	Number of contributing authors
France	521
United States	449
Italy	414
Japan	378
Germany	310
China	278
United Kingdom	278
Spain	255
Korea	213
Czech Republic	140
Mexico	127
Brazil	120
Netherlands	120
Sweden	119
Russian Federation	116
Canada	98
Australia	89
Finland	89
Taiwan	79
Belgium	66
Portugal	64
Poland	63
Greece	58
Romania	51
Hungary	49
Singapore	42

Chile	10
China	278
Iceland	5
India	19
Indonesia	4
Iran	38
Ireland	19
Israel	19
Italy	414
Jamaica	1
Japan	378
Jordan	1
Kenya	1
Korea	213
Latvia	4
Macedonia	7
Malaysia	3
Mexico	127
Morocco	7
Netherlands	120
New Caledonia	1
New Zealand	2
Norway	32
Palestine	1
Poland	63
Portugal	64
Romania	51
Russian Federation	116
Singapore	42
Slovakia	34
Slovenia	27
South Africa	22
Spain	255
Sweden	119
Switzerland	41
Syrian Arab Republic	1
Taiwan	79
Thailand	7
Tunisia	4
Turkey	34
Ukraine	6
United Arab Emirates	4
United Kingdom	278
United States	449
Venezuela	19
Viet Nam	3
Yugoslavia	5

Austria	41
Switzerland	41
Iran	38
Hong Kong	37
Denmark	35
Slovakia	34
Turkey	34
Norway	32
Slovenia	27
South Africa	22
Argentina	20
India	19
Ireland	19
Israel	19
Venezuela	19
Bulgaria	12
Belarus	10
Chile	10
Algeria	9
Estonia	9
Macedonia	7
Morocco	7
Thailand	7
Cuba	6
Ukraine	6
Iceland	5
Yugoslavia	5
Croatia	4
Indonesia	4
Latvia	4
Tunisia	4
United Arab Emirates	4
Armenia	3
Bosnia and Herzegovina	3
Malaysia	3
Viet Nam	3
Cyprus	2
Egypt	2
New Zealand	2
Bangladesh	1
Colombia	1
Jamaica	1
Jordan	1
Kenya	1
New Caledonia	1
Palestine	1
Syrian Arab Republic	1

TOTAL number of contributing authors: 5162

2.2 Number of contributing authors per region

The following World regions are defined: Europe, Asia (excluding Middle East), North America, South America, Australia, Middle East, Africa, Caribbean and Oceania.

Region	Number of Authors
Europe	3012
Asia (excluding Middle East)	1102
North America	674
South America	170
Australia	89
Middle East	60
Africa	45
Caribbean	7
Oceania	3

It is not surprising that more than 3/5 of contributing authors come from Europe as the Congress was held in the hearth of this Continent. Another reason explaining the figure lies in the fact that the IFAC has kept tight links with European countries since its foundation. The figures in the table above however indicate growing research potential and cooperation with IFAC in Asia. Besides Japan, where research and applications in Automatic control is traditionally strong, there is a remarkable growing activity in China and Korea.

3 Industry Contribution

One of the key points of the IFAC World Congress Praha 2005 was to encourage people from industry to attend the Congress either as contributors or passive participants. The reason was to contribute to never ending story of narrowing the gap between academia and industry, academic research and practical needs. The aim was also to demonstrate close academia-industry cooperation during the Congress. Members of the IFAC Technical Board contacted many potential participants from industry in their respective field and motivated them to attend the IFAC Congress.

Who was contacted:

- manufacturers of the automation technology including hardware, software and solutions,
- R&D companies specialized in certain field of automation,
- end users of the automation technology.

The industry participation was supported through:

- "Industry Days" technical program and Industry Days program brochure, which also contained list of all contributing companies,
- advertisement and series of articles introducing the program in journals, IEEE Control Systems Magazine, Automatica and Czech journals subscribed by industrials Automa and Automatizace,
- personal invitation to participate in state of the art plenary, semi-plenary and panel sessions, tutorials and workshops in selected applied areas, namely automotive and transportation in general, power and process (chemical) industries,
- contact primarily those having running research projects with universities and academia. These projects were not necessarily company confidential and represented rather long term interests. The industrial partners did not hesitate to present the achievements or gave rights to the academic partners to write the paper on their behalf,
- invited industry plenary papers (Dr. Chand of Rockwell Automation and Prof. Bruns of Siemens) and a semi-plenary paper (Prof. Havlena of Honeywell),
- panel discussions on up-to-date topics with industrial participation (ABB,…), where the panelists spoke either to colleagues from other companies or to their customers or they wanted that their field is more treated in academia.

It is worse to mention that, besides trends and visions, plenary and semi-plenary speakers presented state of the art in selected areas focusing also on well established and proven (control, simulation, optimization, …) techniques sending a message to academics, which area does not urgently need further research. As an example, the sophisticated control algorithms used in voltage control in electrical generation, transmission and distribution systems successfully used in practice for decades and yet there are many recent papers specifying the problem as "not solved" or "not successfully solved".

We did not hear much about open and practically important problems having no good solution yet. It was clear that companies, manufacturers of automation technology, hesitate to open

such questions, but there were other companies, users of automation, explaining what they need so people in academia could focus research activities in here.

The preparation of industry involvement started during the 1st IPC meeting in Rotterdam, 28 August, 2003.

The effort made by the International Program Committee and members of the IFAC Technical Board resulted in participation of 176 different companies from 30 countries all around the world in the Congress technical program. There were 279 authors from industry authoring or co-authoring papers scheduled for the final program. The following table gives more detailed picture.

Country	Number of companies with a paper
Japan	22
United States	21
Germany	19
Italy	19
France	11
Czech Republic	9
Finland	9
Korea	8
Netherlands	8
Austria	6

Country	Number of companies with a paper
United Kingdom	6
Denmark	5
Canada	4
India	3
Norway	3
Portugal	3
Sweden	3
Switzerland	3
Brazil	2
Poland	2

Country	Number of companies with a paper
Russia	2
Australia	1
Belgium	1
Hungary	1
Macedonia	1
Romania	1
Singapore	1
Slovakia	1
Spain	1
Turkey	1

The complete list of contributing companies is given in the Appendix.

4 Plenary and semi-Plenary sessions

Well-known experts in emerging/important areas of interest within IFAC were invited to share their expertise with Congress participants. Six plenary sessions were organized.

The first plenary speaker was R. Kalman, Swiss Federal Institute of Technology, Zurich, on "The Evolution of System Theory: My Memories and Hopes". There was no chair left in the Congress Hall of the Prague Congress Center as everybody was eager to see and hear the living legend of the System Theory. R. Kalman reviewed the evolution of system theory over the last 100 years, and especially since R. M. Foster's famous 1924 paper. His inevitable conclusion was that (after the basic physical issues have been cleared up) progress or failure in engineering research in system theory has been directly linked to progress or failure in solving the underlying purely mathematical problems, regardless of whether these problems were already the subject of study in another unrelated context or had to be formulated ab initio.

The second plenary speech was industry oriented. S. Chand, Vice President and Chief Technical Officer of Rockwell Automation, Milwaukee, presented plenary paper entitled "From Electric Motors to Flexible Manufacturing: Control Technology Drives Industrial Automation". Industrial Automation has evolved from stand-alone, hard-wired relay panels to

a contemporary, networked system of today that supports flexible manufacturing and enterprise integration. The presentation summarized the major technical trends, and highlighted the continuing opportunities and challenges for the application of control technologies. Trends such as the adoption of open networks like the Ethernet, migration of intelligence to sensors and actuators, and the evolution of semiconductor and sensing technologies, are driving greater distribution of control and decision-making in the architecture. The diversity of future needs was illustrated by two applications described in detail: electric motor control and autonomous agent-based systems for fault-tolerant control. S. Chand introduced the program of the first Industry Day.

The program of the first Industry Day continued by an attractive plenary given by R. Isermann, Institute of Automatic Control, TU Darmstadt, on “Mechatronic Systems: Innovative Products with Embedded Control”. Many technical processes and products in the area of mechanical and electrical engineering are showing an increasing integration of mechanics with digital electronics and information processing. Formerly mechanical functions are replaced by electronically controlled functions, resulting in simpler mechanical structures and increased functionality. Of major importance are the simultaneous design of mechanics and electronics, hardware and software and embedded control functions resulting in an integrated component or system. The contribution summarized ongoing developments for mechatronic systems, presented design approaches and examples of mechatronic products and considered especially the various embedded control functions and systems integrity. R. Isermann started with the historical development and gave definitions for mechatronic systems. Then the design methodology of mechatronic systems was considered, taking into account the design steps of simultaneous, integrated engineering. Typical development models, known as V-models, were shown, including specification, off-line simulation, control prototyping, code generation, function and system testing with hardware-in-the-loop simulation, calibration/tuning of control functions, validation and verification and field testing. Examples of mechatronic systems, like braking systems (ABS, ESP), the brake-by-wire electro-hydraulic brake system (EHB), steering systems (active front steering), active suspension systems, common rail injection systems, variable valve control systems, variable geometry turbochargers and automatic gears, were shown. Realization of embedded control functions for mechatronic systems including reliability and safety functions was discussed. Experimental results were shown for automotive drive dynamic sensors and electrical AC motors. An outlook described the development to intelligent mechatronic systems, fault-tolerant systems and drive-by-wire vehicles and discusses requirements for the education in mechatronics.

The program of the second Industry Day was introduced by plenary presentation given by M. Bruns, Vice President A&D AS Process Automation, Siemens AG. The topic was “Some Trends in Industrial Automation”. Several fast growing technologies were discussed, namely: RFID, Industrial Wireless LAN, with the main goal is to increase reliability to a level where "wireless is as safe as a wire", isochronous RT Ethernet and ICs for this technology. It was explained that the objective of isochronous RT Ethernet is to use the same Ethernet infrastructure for office and also for time critical applications e.g. machine & drive control. Current R&D focuses on refining network traffic control algorithms in order to ensure safe and reliable data transmission. R&D activities in Augmented Reality, as the intelligent combination of normal human visual perception and of computer generated information, were

presented. The plenary went on applications like plant design, complex service & maintenance and remote expert support.

A broadly attractive presentation addressing successful automatic space missions was given in the plenary entitled "The Mars Exploration Rovers: Hitting the Road on Mars" by N. Cox, NASA Jet Propulsion Laboratory, Pasadena. Since the beginning of time, people have been fascinated by Mars. History of missions was covered. Development of Mars Exploration Rovers was explained and their successful landing on Mars in January 2004 was described. The presentation discussed how the Mars Rover mission fitted into the overall Mars Program and NASA. The full story of building the rovers including autonomous control ability on the surface was described. The process of developing and testing autonomous functions was documented. Since landing, NASA had seen those capabilities at work and they have been critical in the rovers success at finding evidence of past water. There was a remarkable and positive feedback from the audience regarding the topic and also the form of the presentation. Unlike the other plenary presentations, N. Cox did not focus on automatic control itself but presented the Aerospace as an application area where automatic control plays a leading role. The presentation itself was a great success. Number of young people discussed the topic with Mrs Cox days after the presentation.

In the "Issues on Robust Adaptive Feedback Control" by M. Athans et al., MIT and Universidade Técnica de Lisboa, the recent progress in the field of robust adaptive control was summarized. A general philosophy for designing "robust" adaptive multivariable feedback control systems for plants that include both unmodeled dynamics and uncertain real parameters in the plant state description was discussed. More recent approaches to the adaptive problem involve multiple-model techniques where the parameter uncertainty set is subdivided into smaller subsets; each giving rise to a different plant model but with reduced parameter uncertainty. The identification of the most likely model was carried out by a "supervisor", which either switches in and out the controllers based primarily on deterministic concepts or relies upon stochastic designs (dynamic hypotheses-testing) that generate on-line posterior probabilities reflecting which of the models is more likely. The following questions regarding models employed were defined: (a) how to divide the initial large parameter uncertain set into N smaller subsets, (b) what should be the size of each subset and (c) how big should N be. The talk focused on "robust performance" requirements on the adaptive system implemented by one of the available multiple-model methods by exploiting recent advances on robust nonadaptive designs using the so-called mixed-mu methodology. A systematic method for selecting the smallest number of models while guaranteeing a priori bounds on desired performance was presented.

Semi-plenary sessions concluded the technical program on Monday and Wednesday. M. Morari, Swiss Federal Institute of Technology, Zurich, presented an attractive talk on "Hybrid Systems: Theory, Computation and Applications". Historical examples and an introduction to the emerging area of hybrid systems, i.e. dynamical systems with switches, were provided. Examples from power electronics, systems with hard bounds and/or friction, driver assistance systems, anesthesia and active vibration control were described as systems belonging to the category. highlight the Theoretical developments were highlighted and the extensive software that helps to bring the theory to bear on the practical examples was mentioned. In conclusion, an outlook for hybrid systems and control was generalized.

The second semi-plenary lecture by J. Bokor, Hungarian Academy of Science, Budapest, and G. Balas, University of Minnesota, was on "Linear Parameter Varying Systems: a geometric theory and applications". Linear Parameter Varying (LPV) systems appear in many modeling and control problems related to aerospace or vehicle system applications. This talk will proposed a geometric view on the LPV systems. Elaborating the geometric concepts and tools of parameter varying invariant subspaces, the authors investigated invariant subspace algorithms for a class of LPV systems. Using the geometric results and the associated invariant subspace algorithms, prototype control problems like disturbance decoupling problem and the like were discussed for affine LPV systems. The advantage gained by using LPV formalism was shown and solutions to some nonlinear problems, that could be hardly computable in the original nonlinear form, were demonstrated. Applications to aerospace control design and road vehicle control systems were shown using MATLAB.

The other two semi-plenary lectures were organized within the program of the second Industry Day. The first semi-plenary lecture of the Industry Day, entitled "A Distributed Automation Framework for Plant-Wide Control, Optimisation, Scheduling and Planning", was prepared jointly by V. Havlena, Honeywell Laboratory Prague, and J. Lu, Honeywell Process Solutions, Phoenix. The objective of the talk was to identify current open problems and trends in plant wide control and demonstrate a solution based on distributed, solution component based architecture for integrated process management, embracing the layers of Advanced Process Control, Real Time Optimisation and Planning & Scheduling, in selected application areas. The problems and outlined solutions were intended to stimulate discussion as well as attract more research interest.

A more specific issue was presented in the last semi-plenary "Systems Engineering for Irrigation Systems: Successes and Challenges" by I. Mareels et al. In Australia gravity fed irrigation systems are critical infrastructure essential to agricultural production and export. By supplementing these large scale civil engineering systems with an appropriate information infrastructure, sensors, actuators and a communication network it is feasible to use systems engineering ideas to improve the exploitation of the irrigation system. The presentation reported how classical ideas from system identification and control can be used to automate irrigation systems to deliver a near on-demand water supply with vastly improved overall distribution efficiency.

5 Milestone Sessions

Milestone session was a special form of a panel discussion organized by the IFAC Technical Board, where Milestone reports describing progress in systems and signals, design methods, computers, cognition and communication, mechatronics, robotics and components, manufacturing, industrial automation, transportation, bio & ecological systems and social systems made between Congresses were presented. The following sections describe individual reports in details.

5.1 Trends in Systems and Signals

The status report was prepared by the IFAC Coordinating Committee on Systems and Signals, i.e. by T. Katayama, T. McKelvey, A. Sano, C. Cassandras and M. Campi. The report discussed problems and methodologies that lie in the broad scope of systems and signals, with special focus on modeling, identification and signal processing; adaptation and learning; discrete event and hybrid systems; and stochastic systems. A common theme underlying all

these areas is that problems in control systems and signals are usually defined and best studied in the framework of stochastic approach. Although there are common precepts among all these technologies, there are also many unique topics within each area. The key problems in each technology were explained, followed by a discussion on recent major accomplishments with trends, and forecasts.

5.2 Theory, Algorithms and Technology in the Design of Control Systems

The report was prepared by the IFAC Coordinating Committee on Design Methods. The authors were R. Bars, P. Colaneri, C. E. de Souza, F. Allgöwer, A. Kleimenov and C. Scherer. The report gave an overview of the current key problems in control theory and design, evaluated recent accomplishments and forecasted some new areas. Design of very large distributed systems was presented as a new challenge to control theory including robust control. Control over the networks became an important application area. Development and use of systems of virtual reality was also mentioned. Distributed hybrid control systems involving extremely large number of interacting control loops, coordinating large number of autonomous agents, handling very large model uncertainties will be in the center of future research. New achievements in bioinformatics will result in new applications.

5.3 Information and Communication Technology in Control

The Status Report was prepared by the IFAC Coordinating Committee on Computers, Cognition and Communication, W. A. Halang, R. Sanz, R. Babuska and H. Roth. A new approach in control engineering “Information Processing for Action"” was presented, in which control, computers, communication and cognition play equal roles in addressing real-life problems from very small-scale devices to very large-scale industrial processes and non-technical applications. Thus, the C2 paradigm of “Computers for Control” is shifting towards the C4 paradigm of “Computers, Communication and Cognition for Control” providing an integrated perspective on the role computers play in control systems and control plays in computer systems. This change is mainly due to new developments in computers and knowledge management, and the rapidly emerging field of telecommunications providing a number of possible applications in control. Control engineers will have to master computer and software technologies to be able to build the systems of the future, and software engineers need to use control concepts to master the ever-increasing complexity of computing systems.

5.4 Mechatronics, Robotics and Components for Automation and Control

The Status Report was prepared by the IFAC Coordinating Committee on Mechatronics, Robotics and Components, A. Ollero, S. Boverie, R. Goodall, J. Sasiadek, H. Erbe and D. Zuehlke. The report was devoted to the analysis of a broad field of Mechatronics, Robotics and Components for automation and control systems. Several subfields were considered: i) components and instruments, involving sensors, actuators, embedded systems and communications; ii) mechatronics concepts and technologies; iii) robotics; iv) human-machine systems, including technical issues and social implications; and v) cost-oriented automation which is a multidisciplinary field involving theory, technologies and application as well as economical and social issues. First current key problems in this field wereintroduced then, the accomplishment and trends were analyzed. Finally, the forecast was presented.

5.5 From Plant and Logistics Control to Multi-Enterprise Collaboration

The Status Report was prepared by the IFAC Coordinating Committee on Manufacturing Systems, S. Y. Nof, G. Morel, L. Monostori, A. Molina and F. Filip. The problems like management of complexity, scalability, increasing costs, coordination and market-based resource allocation, including recent accomplishments and trends, were discussed. The trends in control and automation techniques, manufacturing plant automation, collaborative control through integration and networking, and control methods applied to extended enterprises and large-scale critical infrastructure were presented. A forecast for the next generation manufacturing system; e-work; integration, coordination and collaboration; networked, distributed decision support (NDSS); and active middleware was shown.

5.6 Monitoring and Control of Process and Power Systems: Towards new Paradigms

The Status Report was prepared by the IFAC Coordinating Committee on Industrial Systems, D. Dochain, W. Marquardt, S. Chul Won, O. Malik, and M. Kinnaert. Process and power plant control, along with fault detection/isolation are being addressed by significant on-going research with many theoretical developments focused on improvements for all of these major industrial applications. The report provided an overview of the current key problems, recent accomplishments and trends, as well as a forecast of anticipated developments within this very important field of industrial applications.

5.7 The Impact of Automatic Control on Recent Developments in Transportation and Vehicle Systems

The Status Report was prepared by the IFAC Coordinating Committee on Transportation Systems, U. Kiencke, L. Nielsen, R. Sutton, K. Schilling, M. Papageorgiou and H. Asama. The report focused on the rising need for transportation services and the demand for a higher safety level. While each domain takes specific approach to deal with these demands, a general trend towards automatic co-pilots or even autopilots is visible. In the automotive domain, this is aided by the design of drive by wire systems. In other fields like marine or aerospace systems, the focus of research is on the swarming behavior of multiple vessels. New sensors and networking will also enable more efficient traffic flow control, which will allow for a better use of the resource network capacity. Another reported trend in the vehicle systems sector was modeling of nonlinear system behavior, which has started to replace look-up tables in real time systems.

5.8 Dealing with Bio- and Ecological Complexity: Challenges and Opportunities

The Status Report was prepared by the IFAC Coordinating Committee on Bio- and Ecological Systems, E. Carson, D. Dagan Feng, M.-N. Pons, R. Soncini-Sessa and G. van Straten. The complexities of the dynamic processes and their control associated with biological and ecological systems offer many challenges for the control engineer. Over the past decades the application of dynamic modelling and control has aided understanding of their complexities. At the same time using such complex systems as test-beds for new control methods has highlighted their limitations (e.g. in relation to system identification) and has thus acted as a catalyst for methodological advance. This paper continues the theme of exploring opportunities and achievements in applying modelling and control in the bio- and ecological domains.

5.9 Control System Approaches for Sustainable Development and Instability Management in the Globalization Age

The Status Report was prepared by the IFAC Coordinating Committee on Social Systems, A. Talha Dinibütün, R. Neck, J. Stahre, G. M. Dimirovski, L. B. Vlacic and F. Kile. Advanced information technologies resulting from automation of control and decision expertise have a multitude of impacts on development of national economies within the global economy. The broad area of social systems, being essentially human centered systems, is a cross-, inter- and multi-disciplinary challenge to control community. Social systems in modern civilization, currently undergoing globalization, were reviewed from the systems science viewpoint and on the grounds of recent developments in control science and technology. Recent developments put new emphasis on the social responsibility of the control and automation field during the on-going changes from the cold-war bipolar world to a unipolar one on the way to mankind's multi-polar world of the future. The focus should be on innovative systems approaches, employing new paradigms, to combined knowledge and technology transfer world-wide, that may remedy some of the negative aspects of globalization.

6 Survey Papers

Number of survey papers characterized by a particularly broad scope of the overviewed problems was submitted. As it is not possible to go through all of them let's focus on those that touched the widest audience. The paper by R. Neck gave an introduction to the theory of dynamic games and presented economic applications of the theory. The survey by A. Dolgui et al. was focused on the parameterisation of Material Requirement Planning systems under demand and lead-time uncertainties. Infinite time linear-quadratic control problem was discussed by J. C. Willems et al. from a behavioral point of view. Promising approaches for enhancing the performance of intelligent control systems facing higher level of complexity and uncertainty were surveyed by R. Herzallah. The paper by Il Seop Choi et al. investigated strong and weak points of various control algorithms in the looper-tension technology in hot rolling mills. Another survey by D. Major et al. focused on fundamental and practical aspects of pulp bleaching control. The paper by G. Morel et al. summarized the key problems, trends and accomplishments of manufacturing plant control. An overview of recent advances in wireless communication technologies applied to industrial automation was provided in Mogens L. Mathiesen et al.. The paper by R. Harrison et al. made a case for the widespread adoption of a collaborative automation paradigm, which promises to provide more flexible and reconfigurable production systems. A. Ilchmann surveyed the development of the algebraic theory of time-varying linear systems, while P. Biswas et al. gave a survey on stability analysis of discrete-time piecewise affine systems. The paper by T. Salsbury described the state of the art in control in building automation industry and reviewed new and emerging technologies in this particular field. The paper by K. E. Arzén and A. Cervin provided a survey of the role of feedback control in embedded real-time systems and highlighted recent research efforts and future research directions in this research area.

7 Panel Sessions

Four panel sessions were organized. Three of them were part of the Industry Days program and one was educational.

"Infotronic Technologies for e-maintenance regarding the cost aspects" was a panel organized by G. Morel (CRAN Institute, Univ. Nancy), J. Lee (IMS Center, University of Cincinnati),

H. Erbe (TU Berlin), G. Seliger (TU Berlin and Fraunhofer IPK- Berlin), M. Hecht (TU Berlin, Rail Vehicles), E. Hohwieler (Fraunhofer IPK-Berlin), F. Kimura (Univ. of Tokio), H. Hang (Texas Tech College of Engineering) and D. Kiritsis (EPF, Lausanne). The panel hosted leaders from equipment and service users, equipment and service providers, and experts from academia. Industrial panelists discussed and addressed issues and challenges to realize cost effective e-maintenance strategies. Academic leaders presented the state-of-the-art technologies and tools with examples. An exchange of experience with implemented prognostics of expected equipment failures based on condition monitoring predicting degradation was the main focus of the session.

"Collaborating Robotic Systems (Human – Robot, Robot – Robot)" was a panel organized by H. Erbe and R. Bernhardt. The role of collaboration of human operators and automation systems like robots to achieve more flexibility in production and saving cost by avoiding repeated reconfiguration of the systems was discussed. Collaborative Robots (COBOTS, or intelligent power assist devices (IPAD)) were presented. Compared to the existing systems, the IPAD was described as advantageous in regard to appreciably lower costs, significantly improved ergonomics, simpler intuitive operation, rapid movements with a higher level of precision and considerably reduced stress during manipulation of heavy loads. Stand-alone industry robots are used in a structured environment for welding, painting, and handling. The collaboration of those units in material handling and processing for saving time and manufacturing cost was discussed.

"Industrial Perspectives on Process Control", that was one of the key event of the second Industry Day, was organized by W. Marquardt; A. Isaksson,.B. J. Cott, K.-U. Klatt and J. A. Mandler. This panel discussion provided a forum whereby representatives of major industrial sectors from U.S. and Europe (ABB, Shell, Bayer, Air Products) discussed successful applications of Process Control in industrial practice, identified major needs and opportunities for application of advanced Process Control in industrial problems, and discussed the interplay between academic research in Process Control and industrial practice.

"Rethinking Control Education in the Modern World" was organized by L. Vlacic. In an effort to make the discipline of control more attractive to students the subject is often introduced as an enabling technology in the context of embedded electronic systems, intelligent robots, mechatronic systems, advanced communication systems, space technology, etc. While this approach works well in promoting the field of control, it however raises the following questions: how much of the advanced computing technology do we need to use in presenting the basic control topics; are we going to fall into the trap of being technology driven and thus start to lose analytical problem solving skills; are we about to change the way we teach control; are all of these approaches going to change the profile of the control discipline? The questions were discussed by the panelists, C. G. Cassandras, T. Djaferis, S. Dormido, S. Kahne and M. Spong.

8 Tutorials and Workshops

There were numerous tutorial and workshop proposals received and evaluated by the IPC. Not all the proposed tutorials and workshops were organized due to the number of registered participants. The following events formed the two days pre-Congress program.

8.1 Tutorials

"Control Applications in Physics: From Control of Chaos to Quantum Control" by A. Fradkov, H. Nijmeijer and S. Sieniutycz. In the tutorial a number of new application fields related to studying properties of physical systems by means of feedback were exposed. The subject and methodology of cybernetical physics was outlined. Methods of energy control in conservative and dissipative systems were presented. Applications in physics: feedback resonance phenomenon in nonlinear oscillators, escape from potential wells, control and synchronization in oscillatory chains, etc. were shown. The emerging field of controlling chaotic behavior was introduced presented. Among other methods, feedforward control by periodic signal, linearization of Poincare map (OGY method), and delayed feedback (Pyragas method) were analyzed. Concepts and results related to controlled synchronization were outlined. A brief exposition of control thermodynamics was given and demonstrated on treating physical or economical problems of optimal control and behavior of physical or practical systems under prescribed external conditions that were predicted from suitable variational or extremum principles. An introductory exposition of the field related to control of molecular systems, based on both classical and quantum description of the controlled molecular motion, was given.

"Techniques for Control of Distributed Process Systems" by P. Christofides, D. Dochain, P. Daoutidis and A. Armaou. Advanced techniques for control of distributed process systems were presented starting with overview of distributed process control problems and modeling of distributed process systems. Techniques for control of nonlinear distributed parameter systems, including problems of nonlinear parabolic and hyperbolic PDEs: order reduction, feedback control design, closed-loop stability, handling of practical control issues: robust and adaptive control design for model uncertainty compensation, control subject to input and state constraints including Lyapunov-based and predictive control, control subject to delays, reduction and control of two-time-scale hyperbolic PDEs, were shown. Techniques for control of stochastic distributed parameter systems and modeling of stochastic processes with emphasis on thin film growth, identification of stochastic distributed models and feedback control design with applications were explained.

"TrueTime: Real-Time Control System Simulation Using MATLAB/Simulink" by D. Henriksson, A. Cervin, M. Andersson and K.-E. Arzen. TrueTime is a tool that offers system-wide simulation of the temporal behavior of multi-tasking real-time kernels executing controller tasks. TrueTime also makes it possible to simulate models of common communication network protocols and their influence on networked control loops. The tutorial was a mini-course about the TrueTime simulator and its intended use in the design of real-time control systems. A number of interactive examples were presented to visualize the various aspects of the simulator, e.g. the effect of task scheduling on control performance, task synchronization using monitors and events, interrupt handling and handling of task overruns, and control over wired and wireless networks.

8.2 Workshops

"The Power, Beauty and Excitement of the Cross- Boundaries Nature of Control" was a workshop organized by L. Vlacic and B. Pasik-Duncan. The workshop was sponsored by IFAC and IEEE. The Workshop aimed at inspiring the interest from youth towards studies in

Automatic Control and to assist high school teachers in promoting the discipline of Automatic Control among their students. It was composed of several short but effective presentations on various problems from the real world that had been solved by using control engineering methods, techniques and technologies. The attractiveness and excitement of choosing a career in control engineering was addressed. Live interaction between the presenters and the audience was an important feature of the Workshop. The speakers were T.E. Djaferis (University of Massachusetts, Amherst), C. G. Cassandras (Boston University), M. W. Spong (Urbana), P. Horacek (Czech Technical University in Prague), B. Pasik-Duncan (University of Kansas) and L. Vlacic (Griffith University).

"Nonlinear Model Predictive Control: Introduction and Current Topics" was organized by R. Findeisen, F. Allgöwer, M. Diehl, L. Magni and Z. Nagy. The focus of this tutorial was twofold. Besides an in depth introduction to the basic ideas and principles of (nonlinear) predictive control current application and research issues in NMPC spanning from stability and robustness, output-feedback, efficient numerical solution as well as implementation aspects were discussed. For this purpose the course was split up in six parts: an introduction as well as a historical review of predictive control, how to achieve nominal stability of the closed-loop using NMPC, the robust design of NMPC, an overview on output-feedback in conjunction with NMPC, numerical solution and implementation of NMPC, and applications.

"Fault tolerant control of large complex systems" was organized by L. Marconi and A. Paoli. This full-day workshop aimed at giving an overview of the recent research activity in the area. The program included a general introduction to the Fault Tolerant Control problem with some definitions and description of structural properties of fault tolerant systems. Fault tolerant control architectures in the framework of distributed systems were the key subjects. Methods to design Fault Tolerant Control Systems based on different classes of models were presented and illustrated. Nonlinear systems with uncertainties and discrete event systems (both deterministic and stochastic) were considered and possible solutions to the FTC problem were presented. The speakers were M. Staroswiecki, M. Kinnaert, L. Marconi, T. Parisini, Jakob Stoustrup, Andrea Paoli, N. E. Wu and J. L. Speyer.

"Wireless sensor networks and cooperating objects" was organized by A. Ollero and A. Wolisz. the Workshop will explore the concept of networked embedded devices, where the intelligence in the devices is not only used to simply obtain information about the environment / the supervised "system", but also to exert control on it, which in turn requires intelligence in the devices to make decisions. The workshop reviewed concepts, technologies and applications in wireless sensor networks as well as in cooperating embedded systems for control. The workshop program was inspired by the coordination action entitled "Cooperating Embedded Systems for Exploration and Control featuring Wireless Sensor Networks" (Embedded WiSeNts) funded by the European Commission in the Sixth Framework Program (Information Society Technologies).

9 Sessions

Plenary, semi-Plenary, Milestone, Panel and Regular sessions were organized. The table below gives figures for sessions excluding regular ones.

Session category	number
plenaries	6
semi-plenaries	4
milestones	9
panels	4

Sessions fall into several categories according to the form of the paper presentation. There were sessions with oral and poster presentations. Some sessions were submitted as invited, i.e. contained invited papers, the other sessions were contributed, i.e. contained papers submitted individually. The following table shows number of sessions organized in the respective category. Numbers available for preceding IFAC Congresses are also included.

Session category	Beijing 1999	Barcelona 2002	Prague 2005
poster sessions	46	12	54
oral sessions	215	240	302
invited sessions	NA	NA	98
contributed sessions	NA	NA	258
all kind of sessions	261	252	356

Invited sessions in the table above also include plenary, semi-plenary and all kind of panel sessions. Number of papers included in the respective session category is shown in the table below.

Paper category	number
poster papers	778
oral paper	1638
invited papers	467
contributed papers	1989
Total number of papers	2456

The decision of what paper will be presented orally and what will be a poster was taken by the IPC at the 3rd IPC Meeting organized after the end of the review period. The members of the IPC mostly followed the suggestion of reviewers and a TC Chair regarding the most appropriate form of the presentation of a paper. The general rule was that, unlike in some other conferences, the form of the presentation was decided based on the nature of the paper. The poster presentation did not mean lower paper quality. Much more presentation time was given to a poster. The poster could stay displayed the whole Congress day while a paper presented orally got 20 minutes. This policy was however not well understood by some of the authors and not only the authors. Some universities did not support an author when his/her paper was included in the program as a poster.

10 Technical Areas

Structuring of topics of contributions traditionally matches the structure of the IFAC Technical Board. The following table gives the picture of how many sessions were organized under each Technical Area.

IFAC Clusters and Technical Areas	total	oral	poster
Systems and signals			
Modelling, Identification & Signal Processing	37	28	9
Adaptive and Learning Systems	9	7	2
Discrete Event and Hybrid Systems	12	11	1
Stochastic Systems	6	5	1
Design methods			
Control Design	26	24	2
Linear Control Systems	12	10	2
Non-Linear Control Systems	30	27	3
Optimal Control	12	10	2
Robust Control	15	13	2
Computers, cognition and communication			
Computers for Control	8	7	1
Cognition and Control (AI, Fuzzy, Neuro, Evolut.Comp.)	11	9	2
Computers and Telematics	4	3	1
Mechatronics, robotics and components			
Components and Instruments	7	6	1
Mechatronic Systems	9	8	1
Robotics	17	15	2
Cost Oriented Automation	3	3	0
Human Machine Systems	3	2	1
Manufacturing systems			
Manufacturing Plant Control	11	10	1
Manufacturing Modelling for Management and Control	5	4	1
Enterprise Integration and Networking	4	4	0
Large Scale Complex Systems	5	4	1
Industrial systems			
Chemical Process Control	15	13	2
Mining, Mineral & Metal Processing	7	6	1
Power Plants and Power Systems	9	8	1
Safeprocess	14	12	2

Transportation systems			
Automotive Control	8	7	1
Marine Systems	4	3	1
Aerospace	12	9	3
Transportation Systems	4	3	1
Intelligent Autonomous Vehicles	6	5	1
Bio & ecological systems			
Control in Agriculture	5	4	1
Modelling & Control of Biomedical Systems	7	4	3
Modelling & Control of Environmental Systems	4	3	1
Control of Biotechnological Processes	5	4	1
Social systems			
Economic & Business Systems	5	4	1
Social Impact of Automation	1	1	0
Developing Countries	2	1	1
Control Education	4	3	1
SWIIS	2	2	0
Total	**360**	**302**	**58**

Number of papers included in the final program should also give a good picture of what are the areas having rather larger scope or where is the research concentrated nowadays. Of course the area of modeling and identification is very broad so there is no surprise that this is the leading area accommodating vast number of papers. The table below provides precise figures including number of invite papers per area, which is a good indicator of activities inside the particular community. Some trends could also be estimated when we compare the Prague statistics with that of Barcelona. However the figures should be compared and the conclusions should be taken with care as the difference might be not only due to the increasing research activity in the respective area but also due to the personal initiative and enthusiasm of members of the IFAC Technical Board and people who organized invited sessions.

	IFAC Clusters and Technical Areas	papers b'02 *)	papers Praha'05	invited papers Praha'05
	Systems and signals			
1.1.	Modelling, Identification & Signal Processing	140	235	25
1.2.	Adaptive and Learning Systems	63	67	6
1.3.	Discrete Event and Hybrid Systems	36	74	25
1.4.	Stochastic Systems	28	50	0
	Design methods			
2.1.	Control Design	147	179	31
2.2.	Linear Control Systems	83	83	18
2.3.	Non-Linear Control Systems	142	209	36
2.4.	Optimal Control	52	94	17
2.5.	Robust Control	99	107	7
	Computers, cognition and communication			
3.1.	Computers for Control	45	39	19
3.2.	Cognition and Control	86	87	0
3.3.	Computers and Telematics	13	26	12

	Mechatronics, robotics and components			
4.1.	Components and Instruments	13	34	20
4.2.	Mechatronic Systems	23	60	19
4.3.	Robotics	93	130	7
4.4.	Cost Oriented Automation	13	10	5
4.5.	Human Machine Systems	8	24	0
	Manufacturing systems			
5.1.	Manufacturing Plant Control	47	59	36
5.2.	Manufacturing Modelling for Management and Control	45	35	0
5.3.	Enterprise Integration and Networking	7	23	17
5.4.	Large Scale Complex Systems	24	39	11
	Industrial systems			
6.1.	Chemical Process Control	80	105	36
6.2.	Mining, Mineral & Metal Processing	28	57	16
6.3.	Power Plants and Power Systems	48	75	12
6.4.	Safeprocess	116	96	12
	Transportation systems			
7.1.	Automotive Control	50	56	1
7.2.	Marine Systems	20	23	0
7.3.	Aerospace	42	67	36
7.4.	Transportation Systems	10	32	0
7.5.	Intelligent Autonomous Vehicles	19	38	0
	Bio & ecological systems			
8.1.	Control in Agriculture	20	24	8
8.2.	Modelling & Control of Biomedical Systems	24	59	0
8.3.	Modelling & Control of Environmental Systems	21	38	0
8.4.	Control of Biotechnological Processes	36	32	18
	Social systems			
9.1.	Economic & Business Systems	15	27	6
9.2.	Social Impact of Automation	14	6	6
9.3.	Developing Countries	1	10	6
9.4.	Control Education	19	36	6
9.5.	SWIIS	6	11	11
	Total		**2456**	485

*) The structure of the IFAC Technical Board for Barcelona and Prague was different so the papers reported for Barcelona were re-classified into areas valid for Prague. The total number of b'02 papers was not changed.

11 No Show Papers

It was assumed that authors submitted their papers in good faith, that is, they did intend to attend the Congress. No-show papers will not be published in the Congress Proceedings. Only 2,4 % oral presentations and 2,6 % posters, out of the total number of papers scheduled for the final program, was not presented. This number is extremely low.

12 Reviewers

A special thanks is passed to thousands of reviewers who evaluated papers submitted to the Congress. The table below, with number of reviewers authorized by a TC Chair to submit

reviews, shows how was the review process organized and what was the average load of a reviewer within the IFAC Technical Committee.

	IFAC Clusters and Technical Areas	submitted papers	reviewers
	Systems and signals		
1.1.	Modelling, Identification & Signal Processing	315	86
1.2.	Adaptive and Learning Systems	90	68
1.3.	Discrete Event and Hybrid Systems	109	50
1.4.	Stochastic Systems	70	56
	Design methods		
2.1.	Control Design	242	202
2.2.	Linear Control Systems	138	278
2.3.	Non-Linear Control Systems	283	506
2.4.	Optimal Control	121	104
2.5.	Robust Control	160	150
	Computers, cognition and communication		
3.1.	Computers for Control	53	81
3.2.	Cognition and Control (AI, Fuzzy, Neuro, Evolut.Comp.)	126	107
3.3.	Computers and Telematics	31	23
	Mechatronics, robotics and components		
4.1.	Components and Instruments	41	27
4.2.	Mechatronic Systems	82	59
4.3.	Robotics	153	95
4.4.	Cost Oriented Automation	11	29
4.5.	Human Machine Systems	25	11
	Manufacturing systems		
5.1.	Manufacturing Plant Control	94	68
5.2.	Manufacturing Modelling for Management and Control	41	37
5.3.	Enterprise Integration and Networking	28	41
5.4.	Large Scale Complex Systems	43	44
	Industrial systems		
6.1.	Chemical Process Control	132	69
6.2.	Mining, Mineral & Metal Processing	61	35
6.3.	Power Plants and Power Systems	102	77
6.4.	Safeprocess	162	135
	Transportation systems		
7.1.	Automotive Control	74	36
7.2.	Marine Systems	33	13
7.3.	Aerospace	77	26
7.4.	Transportation Systems	37	71
7.5.	Intelligent Autonomous Vehicles	55	34
	Bio & ecological systems		
8.1.	Control in Agriculture	31	45
8.2.	Modelling & Control of Biomedical Systems	65	26
8.3.	Modelling & Control of Environmental Systems	41	28
8.4.	Control of Biotechnological Porcesses	45	38

	Social systems		
9.1.	Economic & Business Systems	42	22
9.2.	Social Impact of Automation	6	14
9.3.	Developing Countries	10	32
9.4.	Control Education	44	39
9.5.	SWIIS	11	10
	Total	**3284**	**2872**

Note that some of the names were registered under multiple areas. The total number of reviewers is thus lower than the sum indicated in the above table. Actual number is 2054, i.e. less than 28% of reviewers served more than one technical area.

13 Appendix – Complete list of companies contributing to the Congress program

No of co-authors from the company	Company	Country
1	2-control ApS	Denmark
1	A.P.I. Refinery Falconara	Italy
1	Aalborg Industries A/S	Denmark
1	ABB	Belgium
1	ABB	Norway
2	ABB Automation Technologies AB - Robotics	Sweden
5	ABB Automation Technology	Sweden
2	ABB Corporate Research Ltd.	Switzerland
1	ABB Corporate Research, Ladenburg	Germany
1	AFRL, Munitions Directorate, Eglin Air Force Base	United States
2	AG der Dillinger Hüttenwerke	Germany
2	Agrotechnology & Food Innovations B.V.	Netherlands
4	AIRBUS	France
1	Aldec-ADT, Advanced Design Technology	Poland
1	ALSTOM Switzerland Ltd.	Switzerland
1	Alstom Transport	France
1	API Oil Industry	Italy
1	Arca Tecnologie s.r.l.	Italy
4	ARCsr GmbH / Mechatronic Automation Systems	Austria
1	Areva T&D Ltd	United Kingdom
1	AspenTech	Italy
1	AspenTech	United Kingdom
1	ASTI Control S.A, Bucharest	Romania
1	Atlas Copco Compressor Int. Slovakia	Slovakia
1	Aucotec GmbH	Germany
2	Audi AG I/EF-56	Germany
2	AUTEC s.r.o.	Czech Republic
2	BAE Systems	United Kingdom
1	BAE Systems, Advanced Information Technologies	United States
1	Bailey Japan Co. Ltd.	Japan
1	BASF Aktiengesellschaft, Ludwigshafen	Germany
1	BizT@lk AG	Germany
1	BNW AG E-30	Germany
1	BOC	Austria
1	BPBiT Leader (Leading Designer)	Poland
2	Brembo	Italy
1	Camotion Inc.	United States
1	Centre Technique Renault	France
6	Centro Ricerche Fiat	Italy
1	CESI spa	Italy

No of co-authors from the company	Company	Country
1	Cimmedia Ltd	United Kingdom
1	CIPAN S.A.	Portugal
1	Comau S.p.A.	Italy
1	COMPUREG Plzen, s.r.o.	Czech Republic
1	Conwell Ltd. Co.	Korea
1	DAF Trucks NV	Netherlands
3	Daimler Chrysler AG	Germany
1	Danfoss A/S	Denmark
1	Danieli Automation SpA	Italy
2	DASFOS, v.o.s.	Czech Republic
1	Data Storage Institute	Singapore
1	Davidson Technologies, Inc.	United States
1	Delphi Diesel Systems	France
3	DENSEI-LAMBDA K.K.	Japan
2	Deutsche BP AG	Germany
1	DHV water BV	Netherlands
5	DLR - German Aerospace Center	Germany
1	Eaton Innovation Center	United States
1	ECOTRONICS GmbH	Austria
2	Electricité de France	France
1	Elettronica Santerno	Italy
2	Ferrari Spa	Italy
1	Finnforest Ltd.	Finland
1	Firmenich SA	Switzerland
3	FLS Automation A/S	Denmark
3	Ford Motor Company	Germany
3	Ford Motor Company	United States
3	Fuji Electric Advanced Technology Ltd.	Japan
1	GalpEnergia	Portugal
3	GE Global Research	United States
1	Gebr. Lang GmbH Papierfabrik	Germany
1	General Motors Research & Development Center	United States
1	Global Software Group, Motorola	United Kingdom
1	GTS Industries Group Dillinger Hütte	France
1	GTZ, Technology Transfer Center Skopje	Macedonia
1	Hartwall Ltd	Finland
3	Hewlett-Packard Company	United States
2	Hitachi Global Storage Technologies	United States
1	Hitachi Industries Co. Ltd.	Japan
1	Hitachi Ltd.	Japan
1	Hitachi STRC	Japan
2	Honda R&D	Japan
8	Honeywell Laboratories Prague	Czech Republic
2	Honeywell Labs	United States

No of co-authors from the company	Company	Country
1	Honeywell Ltd.	India
1	Honeywell Process Solutions	United States
2	Hospital Clínico San Carlos	Spain
1	Hydrion BV	Netherlands
1	IAV GmbH	Germany
1	IBM	United States
1	Idpiconseil	France
1	IMV CORPORATION	Japan
1	INAIL - Centro Protesi	Italy
2	Infoteam GmbH	Germany
1	Instron Ltd	United Kingdom
4	Intecs S.p.A.	Italy
1	Intel	United States
1	Intellimicrons	Korea
1	Ishikawajima-Harima Heavy Industries Co., Ltd.	Japan
1	ISRO-Thiruvananthapuram	India
3	JAKK	Finland
1	Japan Aerospace Exploration Agency, Institute of Space and Astronautical Science	Japan
2	Jet Propulsion Laboratory	United States
4	JFE Advantech Co., Ltd.	Japan
5	JFE R&D Corp.	Japan
14	JFE Steel Corporation	Japan
1	Johnson Controls, Inc.	United States
3	KERI	Korea
1	KITE Solutions	Italy
1	KNICS R&D Center	Korea
7	Kobe Steel Ltd.	Japan
1	Kulicke @ Soffa Industries, Inc.	United States
1	Kumamoto Technology Inc.	Japan
1	Kushu Measurement & Control Co.	Japan
1	Kybertec, Ltd.	Czech Republic
1	LG Cable Ltd	Korea
1	LG Chemical	Korea
2	LG Industrial Systems	Korea
1	Los Alamos National Lab	United States
2	MAGNA STEYR	Austria
1	Magneti Marelli Powertrain	Italy
1	Memcor Australia Pty Ltd	Australia
7	Metso Automation	Finland
1	Microsoft Corp.	United States
1	Microsoft s.r.o. Prague	Czech Republic
2	Mitsubishi Electric Corporation	Japan
1	Mitsubishi Heavy Industries	Japan

No of co-authors from the company	Company	Country
1	Nalco Finland Oy	Finland
1	NASA, Jet Propulsion Laboratory	United States
1	National Aerospace Laboratory NLR	Netherlands
1	NHK Science and Technical Research Laboratories	Japan
4	Nippon Steel Corp.	Japan
5	NIPPON STEEL CORPORATION	Japan
1	Nittetsu Elex Corporation	Japan
2	Novozymes A/S Bagsvaerd	Denmark
1	Omron	Portugal
3	OMRON Advanced Systems, Inc.	United States
2	OMRON corporation	Japan
1	Optimal Synthesis Inc, Palo Alto	United States
1	Outokumpu Stainless Oy	Finland
1	P&C Tech.	Korea
1	P&P Software	Switzerland
1	Papier Masson	Canada
1	Paprican	Canada
2	PARADES	Italy
1	Petrobras	Brazil
2	Philips Applied Technologies	Netherlands
1	Phoenix ISI	France
5	POSCO	Korea
1	POSCO Technology Laboratory	Korea
1	Priva B.V.	Netherlands
4	PROFACTOR Produktionsforschungs GmbH	Austria
2	Profactor Research	Austria
2	PROFIBUS International	Germany
1	ProTyS Inc.	Czech Republic
2	PSA Peugeot Citroën	France
1	Rautaruukki Oyj, Ruukki Production, Raahe	Finland
1	RIKEN	Japan
2	Robert Bosch GmbH	Germany
1	Rockwell Automation	Czech Republic
5	Rockwell Automation	United States
1	Samsung Adv. Inst. of Tech.	Korea
1	Samsung Advanced Institute of Technology	Bulgaria
1	Samsung Co.	Korea
2	Samsung Electronics Co. Ltd.	Korea
1	Samsung Fine Chemicals Co. Ltd.	Korea
1	Satra, Ltd.	Czech Republic
1	SC Solutions	United States
5	Scania	Sweden
1	Scietific and Production Corporation IRKUT	Russian Federation
1	SDA Bocconi	Italy

No of co-authors from the company	Company	Country
1	Schneider Electric	Germany
11	Siemens AG	Germany
1	Siemens Automobilové systémy s.r.o.	Czech Republic
3	Siemens Automotive	Canada
1	Siemens Canada Limited	Canada
2	SINTEF	Norway
1	Snecma Moteurs	France
2	ST Microelectronics	France
1	State Researsh & Production Rocket-Space Center	Russian Federation
2	STATOIL	Norway
1	STMicroelectronics Catania site	Italy
1	Stora Enso Oyj	Finland
1	Swedish Defence Research Agency	Sweden
1	Sym Consulting on Industrial Process Control	Brazil
1	Syncrude Canada Ltd.	Canada
1	System & Dynamik / Beratungsunternehmen	Germany
1	Systemexpert Ltd.	Hungary
5	Tata Consultancy Services	India
1	Tata Research Development & Design Centre	India
1	Telerobot srl	Italy
1	Telescope Technologies Limited	United Kingdom
1	TEPCO SYSTEMS CORPORATION	Japan
2	The Boeing Company	United States
1	TNO Automotive	Netherlands
2	TNO Science and Industry	Netherlands
1	Toronto Co	Canada
1	Toshiba Corporation	Japan
3	TOTAL	France
1	Toyota Motor Corporation	Japan
1	Třinecké železárny, a.s.	Czech Republic
1	Turkish Naval Forces, Turkish Naval Research Center Command	Turkey
1	United Energy	Czech Republic
1	US Air Force Research Laboratory	United States
1	VOEST ALPINE Industrieanlagenbau Linz	Austria
4	Volvo Aero Corporation	Sweden
1	Volvo Cars	Sweden
2	Volvo Technology Corporation	Sweden
2	VTT	Finland
1	Westinghouse Electric Company, LLC	United States
1	Xerox Corporation	United States
1	Yokogawa Electric Corporation	Japan
1	Z/I Imaging Corporation	United States
1	ZF Lenksysteme	Germany

14 Appendix –Program Committee and sub-Committees for Praha 2005

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Michael Šebek (CZ)

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Bohumil Šulc (CZ)
Michael Valášek (CZ)
Tomáš Vlček (CZ)
František Zezulka (CZ)
Pavel Zítek (CZ) - Editor

International Program sub-Committees

1.1 Modelling, Identification & Signal Processing	T. McKelvey (SE)
1.2. Adaptive and Learning Systems	A. Sano (JP)
1.3. Discrete Event Dynamic Systems	C. Cassandras (US)
1.4. Stochastic Systems	M. Campi (IT)
2.1. Control Design	P. Colaneri (IT)
2.2. Linear Control Systems	C.E. de Souza (BR)
2.3. Non-Linear Control Systems	F. Allgöwer (DE)
2.4. Optimal Control	A. Kleimenov (RU)
2.5. Robust Control	C. Scherer (DE)
3.1. Computers for Control	R. Sanz (ES)
3.2. Cognition and Control	R. Babuska (NL)
3.3. Computers and Telematics	H. Roth (DE)
4.1. Components and Instruments	S. Boverie (FR)
4.2. Mechatronic Systems	R. Goodall (UK)
4.3. Robotics	J. Sasiadek (CA)
4.4. Cost Oriented Automation	H. Erbe (DE)
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5.3. Enterprise Integration and Networking	A. Molina (MX)
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6.3. Power Plants and Power Systems	O.P. Malik (CA)
6.4. Safeprocess	M. Kinnaert (BE)
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7.3. Aerospace	K. Schilling (DE)
7.4. Transportation Systems	M. Papageorgiou (GR)
7.5. Intelligent Autonomous Vehicles	H. Asama (JP)
8.1. Control in Agriculture	G. van Straten (NL)
8.2. Modelling & Control of Biomedical Systems	D. Feng (AU)
8.3. Modelling & Control of Environmental Systems	R. Soncini-Sessa (IT)
8.4. Control of Biotechnological Processes	M. Pons (FR)
9.1. Economic & Business Systems	R. Neck (AT)
9.2. Social Impact of Automation	J. Stahre (SE)
9.3. Developing Countries	G. Dimirovski (MK)
9.4. Control Education	L. Vlacic (AU)
9.5. SWIIS	F. Kile (US)