



1993
No. 4
August

Newsletter

Contents:

Architectures for Integrating
Manufacturing Activities
IFAC/IFIP Task Force

*

New Publications

*

Mathematical and Intelligent Models
in System Simulation - MIM-S² '93
IMACS/IFAC Symposium
Belgium

*

Editor's Note

*

On-Line Fault Detection and Supervision
in the Chemical Process Industries
IFAC Symposium, USA

*

Control Engineering Practice
Volume 1, No. 4, Preview

*

Papers from the Next Issue of Automatica

*

Control Applications of Optimization
IFAC Workshop, Germany

*

Automation in Mining, Mineral and
Metal Processing
IFAC Symposium, China, P.R.

*

Last Call - Newsletter Survey

Architectures for Integrating Manufacturing Activities and Enterprises

IFAC/IFIP Task Force

One of the major decisions made by IFAC at its 11th Triennial congress in Tallinn, Estonia, in August 1990, was to propose to IFIP that they develop the above Task Force together. While these Federations had previously co-organized and co-sponsored many Conferences, Symposia and Workshops, this was the first time they had jointly fielded a technical 'working group' to investigate a new technical area together. IFAC was represented in this cosponsorship by its Manufacturing Technology Committee and its Computers Committee. The Technical Committee on Computer Applications in Technology (TC-5) was the IFIP sponsorship partner. Each Federation nominated a group of individuals for membership. Professor Theodore J. Williams, of Purdue University, USA, was named Chairman.

The architectures studied by the Task Force are becoming very important because they provide examples, patterns, frameworks, guidelines, instructions and other types of project development aids to persons making systems engineering studies of all kinds of enterprise development projects. These architectures are themselves models (graphical, descriptive, annotative, etc.) of the process of development of the enterprise project or the physical system and/or its components involved. Such architectures were initially prepared to help design computer integrated manufacturing (CIM) systems for the discrete manufacturing industries. Their use is now rapidly expanding into all other types of manufacturing and indeed into all types of enterprises regardless of the industry or type of business involved.

The mission of the Task Force was to review the available set of applicable architectures, develop a measure of the users' needs with respect to such architectures and then evaluate a selection of the architectures as to their capability to fulfill the expressed needs just determined. Initially, because of the amount of available manpower, the Task Force picked three major candidate architectures, CIM-OSA of the AMICE Consortium of the EC-ESPRIT Project; GRAI-CIM of the University of Bordeaux, France; and the Purdue Enterprise Reference Architecture of Purdue University, USA for their investigation. The developers of these architectures were all represented in the Task Force membership thus assuring a detailed investigation of them.

Later it was found that these three architectures were a fortunate selection from among those available at the time since they were the prime ones of those reviewed which came the closest to satisfying their users' needs. This was because they were architectures of the life history of the Enterprise itself rather than being merely physical or functional descriptions of part of the system of that enterprise. It had also been determined by

the Task Force at about the same time that it was this type of life history or project development architecture which was of the most value to the user of these systems. Each of the other, non-project life cycle type architectures then become constituent parts of the overall project type architectures acting as enabling technologies. This is because the component type physical architectures fulfill specific needs for the completion of the project as expressed by the larger architecture.

Because of the newness of this field, the Task Force also found that none of the candidate architectures was complete in fulfilling all the needs of the user in planning, developing and operating his proposed integrated enterprise system. However, recommendations were made which would allow any of the candidate architectures to be 'completed'. Also presented was a proposal to take the best parts of each candidate architecture to develop a new architecture which would be synergistically superior to either of the candidates alone. Proposals were also made to help solve the continuing problem of the massive amounts of detail always present for the user to handle with projects of this kind.

The Task Force has been very active in the period since its formation. Six major meetings have been held with a considerable correspondence between meetings. The Task Force will present a major report at the 12th IFAC Congress in Sydney, Australia in July 1993 and at the next IFIP TC-5 Conference in Phoenix, Arizona, USA in September. Its major technical report will also be published jointly by IFAC and IFIP in book form.

For more information please contact:

Dr. Theodore J. Williams
Purdue Laboratory for Applied Industrial
Control
Purdue University
1293 Potter Center, Room 334
West Lafayette, IN 47907-1293, USA
Phone: (317) 494-7434
Fax: (317) 494-2351
e-mail: tjwil@niblick.ecn.purdue.edu

or

Dr. Laszlo Nemes
CSIRO - Australia
Integrated Manufacturing Program
Division of Manufacturing Technology
Cnr. Albert and Raglan Streets
Preston, Victoria, Australia
Phone: +61-3-662-7707 or 7700
Fax: +61-3-662-7851 or 7852
e-mail: Inm@mlb.dmt.csiro.au

New Publications

Nonlinear Control Systems Design 1992
IFAC Symposium (2nd)
Bordeaux, France
24 - 26 June, 1992
Selected Papers
Editor: M. Fliess, France

This volume represents most aspects of the rich and growing field of nonlinear control. It contains 78 papers, including six plenary lectures, striking a balance between theory and applications. Subjects covered include feedback stabilization, nonlinear and adaptive control of electromechanical systems, non-holonomic systems. Generalized state space systems, algebraic computing in nonlinear systems theory, decoupling, linearization and model-matching and robust control are also covered.

Motion Control for Intelligent Automation
IFAC Workshop
Perugia, Italy
27 - 29 October, 1992
Selected Papers

Editors: A. de Carli, Italy, E. Masada, Japan
Motion Control is a rapidly evolving topic, with a wide range of applications, especially in robotics. Speed and position control of a mechanical system has always been one of the main problems in automatic control, as the demand increases for advanced levels of accuracy and dynamics. The study of motion control aims to combine theoretical approaches with the realization of mechanical systems characterized by high levels of performance. The IFAC Workshop focussed on the development of: Mechanical systems modelling; control strategies; intelligent instrumentation; dedicated microprocessor devices; and new fields of applications.

Automation in Mining, Mineral and Metal Processing 1992
IFAC Symposium (7th)
Beijing, China, P.R.
26 - 28 August, 1992
Selected Papers

Editors: Gu Yan, Chen Zhen-Yu, China, P.R.
The purpose of this Symposium was to exchange ideas and approaches relating to the latest development of factory automation in mining, mineral and metal processing. This volume begins with the four plenary papers, concerning the automation of mineral processes, automation in iron and steel industries, sensor technology and artificial intelligence technique. 38 technical papers are included, covering mining and mineral automation, blast furnace automation, steel making automation, MIS & CIMS in the steel industry and measuring technique.

CIM in Process and Manufacturing Industries
IFAC Workshop
Helsinki, Finland
23 - 25 November, 1992
Selected Papers
Editor: K. Leiviskä

This volume contains papers presented at the CIM in Process and Manufacturing Industries Workshop, and covers all aspects including: Modelling, analysis and design; intelligent tools; systems and system concepts; and computer and software development.

Information Control Problems in Manufacturing Technology 1992
IFAC/IFIP/IFORS/IMACS/ISPE Symposium (7th)
Toronto, Ontario, Canada
25 - 28 May, 1992
Selected Papers
Editor: M. B. Zaremba, Canada

These proceedings contain more than 80 of the best papers presented at the INCOM '92 Symposium,

and relate to the vast changes which are occurring worldwide in manufacturing technology. Research oriented technical papers cover subjects such as: Simulation of manufacturing processes; sensor based robots; information systems; general aspects of CIM and manufacturing networks.

Adaptive Systems in Control and Signal Processing 1992
IFAC Symposium (4th)
Grenoble, France
1 - 3 July, 1992
Selected Papers

Editors: L. Dugard, M. M'Saad, I. Landau, France

Adaptive Systems remain a very interesting field of theoretical research, extended by methodological studies and an increasing number of applications. The plenary papers, invited sessions and contributed sessions focussed on many aspects of adaptive systems, such as systems identification and modelling, adaptive control of nonlinear systems and theoretical issues in adaptive control of nonlinear systems and theoretical issues in adaptive control. Also covered were methodological aspects and applications of adaptive control, intelligent tuning and adaptive signal processing.

A Cost Effective Use of Computer Aided Technologies and Integration Methods in Small- and Medium Sized Companies
IFAC Workshop
Vienna, Austria
7 - 8 September, 1992
Selected Papers

Editor: P. Kopacek, Austria

The objective of this 1st Workshop was to bring together end-users, manufacturers and (computer) control specialists to evaluate possibilities in the important field of factory automation. This volume offers solutions for product, process design, production design and control. Technical criteria are also discussed and economic justification methods are evaluated. The papers included present intelligent, modular, 'low cost' approaches or solutions appropriate for small- and medium-sized companies which might benefit from improved efficiency and competitiveness.

Intelligent Components and Instruments for Control Applications
IFAC Symposium
Malaga, Spain
20 - 22 May, 1992
Selected Papers

Editors: A. Ollero, E. F. Camacho, Spain

Intelligent control is an emergent field involving the development of new control techniques, such as reasoning, learning and perception, and has a great impact on a number of applications including robotics and process control. The symposium brought together control systems specialists, equipment manufacturers, and end-users, to evaluate techniques, components, and instruments for intelligent control. The selected papers in this volume cover intelligent control techniques, actuators, sensors, image processing, computer vision, software and communications. Papers relating to applications, such as robotics, power and process control, manufacturing, aerospace and traffic control are also included.

Analysis, Design and Evaluation of Man-Machine Systems 1992
IFAC/IFIP/IFORS/IEA Symposium (5th)
The Hague, Netherlands
9 - 11 June, 1992
Selected Papers
Editor: H. G. Stassen, Netherlands

Containing four plenary papers and 38 technical papers, this volume contributes to the literature on the important subject of man-machine systems. The many topics discussed include human performance skills, knowledge engineering and expert systems, training procedures, human performance and mental load models, and human-machine interfaces.

Mathematical and Intelligent Models in System Simulation (MIM-S²'93)

IMACS/IFAC Symposium

Brussels, Belgium

12 - 16 April, 1993

Well-known Belgian organization and hospitality combined to make this a memorable Symposium. Organized by the IMACS Technical Committee on Control Systems and Robotics with the cooperation of the IMACS Technical Committee on Knowledge-Based Systems in Mathematical Modelling, co-sponsored by IMACS, IFAC and IBRA/BIRA, this event was the second in a series begun in 1992.

The purpose of this Symposium was to provide a forum for presentation and discussion of recent advances of system modelling and simulation in different disciplines with emphasis on the coupling of mathematical and intelligent techniques.

After a thorough review process, 67 papers remained to be presented at the Symposium. There were also 9 invited sessions, representing 46 papers selected directly by the inviting persons.

Eight well-known international specialists in different fields were invited by the IPC to present survey papers on special topics. These were:

Prof. R. Vichnevetsky, USA, 'Reflexions on Mathematical Modelling - Past and Present'
Prof. M. Vukobratovic, Yugoslavia, 'High Fidelity Mathematical Models for Analysis and Control Synthesis in Contact Robotic Tasks'
Prof. I. Troch, Austria, 'Modelling for Optimization'
Prof. P. M. Frank, Germany, 'Model-Based Fault Diagnosis'
Prof. S. Tzafestas, Greece, 'Process in Biped Robots: Models and Prototypes'
Prof. I. Dumitrache, Romania, 'Modelling and Control of Bioprocesses'
Prof. M. Silva, Spain, 'Performance Models Based on Petri Nets'
Prof. E. Mosca, Italy, 'Implicit Models for Controlled Stochastic Systems'

100 participants had registered for the meeting. There were 23 technical sessions with 5-6 papers each. Presentation of each paper was followed by a discussion period. Two survey papers were not presented.

The scientific quality of the papers and their presentation was generally very high.

Prof. R. Hanus
NOC Chairman

Editor's Note

This Issue of the IFAC Newsletter is being produced at the same time as the IFAC World Congress is held in Sydney, Australia.

The October Issue of the Newsletter will therefore be almost exclusively dedicated to a thorough review of technical and administrative news relating to IFAC

On-Line Fault Detection and Supervision in the Chemical Process Industries

IFAC Symposium

Newark, Delaware, USA, April 22 - 24, 1992

Control Engineering Practice

Volume 1 Number 4

August 1993

Total quality management has become the centerpiece of industrial production at large. From the large, continuous-processing refineries and bulk commodities plants, to the batch-processing specialty chemicals, pharmaceuticals, food and materials, one observes a frenetic effort to improve product quality, human safety, environmental impact, equipment protection, and economic performance. Thus, in a fast-, and ever-changing world and a globally competitive market, to capture temporal variations in price, exploit geographic inequities, minimize variabilities in product quality and delivery to the market - all this has become synonymous to staying 'alive'. It is not surprising, therefore, that the level of industrial and academic activity around the issues of Process Supervision and Diagnosis has grown at an explosive rate, fuelled and propelled by the ever increasing presence and usage of computers.

The IFAC Symposium 'On-Line Fault Detection and Supervision in the Chemical Process Industries' came both as a response to the industrial needs, and as a proactive initiative to shape the developments to come. It was held in Newark, Delaware, USA and attracted 117 members of a well-represented community of academic and industrial researchers, as well as industrial practitioners from 20 countries.

The 52 papers presented at the Symposium can be grouped in five major parts, as follows:

- Part I:** Strategies for the Detection and Diagnosis of Process Faults;
- Part II:** Modeling, Validation, and Interpretation of Process Trends;
- Part III:** Supervision and Control of Chemical Plants;
- Part IV:** Neural Networks in Process Supervision and Fault Diagnosis;
- Part V:** Industrial Applications in Process Supervision and Fault Diagnosis.

The papers cover both theoretical and practical/implementation aspects of the Symposium's themes. In the following paragraphs, we will summarize the scope of the contributions, both in terms of their theoretical contributions and the directions for further industrial developments.

Part I: Strategies for the Detection and Diagnosis of Process Faults

The sixteen papers in this part cover a broad range of methodologies and discuss their relative strengths and weaknesses. Model-based (quantitative and/or qualitative), rule-based (deterministic, fuzzy or probabilistic), graph-based, or other, the composite picture that these papers paint conveys a simple message: 'If the knowledge about a plant is exact, the diagnosis is straightforward, decidable and complete. Therefore, the variations among the different approaches stem from the different strategies used to represent and utilize the ever present uncertainty in the process behaviour and external influences (faults).'

Part II: Modeling, Validation and Interpretation of Process Trends

The ten papers in this section address the pivotal issues of processing the available, on-line and off-line measurements, and producing descriptions of process trends which can be used by the diagnostic approaches. The particular philosophy in handling measurements depends entirely on how the diagnostic procedure handles uncertainty. Thus, multi-resolution analysis of measurements provides information at various time-scales; qualitative interpretation of trends feeds qualitative model-based approaches; statistical representation of measurements enhances probabilistic assessment of control/process operations.

Part III: Supervision and Control of Chemical Plants

Six papers deal with various aspects of process supervision and control, such as: optimum management of resources, synthesis of operating procedures, supervision for the protection and well-being of process equipment, and the supervision of

adaptive control systems. These contributions indicate a need for integrating systems theoretical aspects from control theory, optimization theory, statistics, with more recent developments in artificial intelligence and computer science.

Part IV: Neural Networks in Process Supervision and Fault Diagnosis

The eight papers in this section offer a significant frontal advance on the use of Neural Networks for handling a number of important questions, such as: classification of operational trends, fault diagnosis, supervisory control. They also discuss the strengths and weaknesses of various network configurations and elucidate the mathematical foundations of such networks, using different forms of activation functions. The experience and insights that these papers offer are certain to enhance the future stature of this technology.

Part V: Industrial Applications in Process Supervision and Fault Diagnosis

The twelve papers in this section provide a fairly good spread of industrial processing systems and supervisory/decision support problems. They indicate conclusively the industrial viability of the evolving technologies, and they possess sophistication which transcends the limitations of the simple-minded applications a few years ago. At the same time they convey a strong sense that the industrial milieu is quite prepared to take the next major step, i.e. promote and apply the new technologies as part of a normal course, rather than as an interesting technology for pilot case-studies. This is a very promising and exciting development.

Any conference - and the IFAC Symposium on 'On-Line Fault Detection and Supervision in the Chemical Process Industries' is no exception - should be the starting point for the next phase of technological developments. In the course of the paper presentations and associated discussions, certain central messages became evident and should become part of the Symposium's archives.

Message 1: The industrial importance of the Symposium's themes is very high and is expected to become even higher. Consequently, a formalized approach to guarantee the continuation of this effort through future Symposia was strongly voiced by all participants.

Message 2: The theoretical foundations for the description of process trends, the development of the requisite process models, the tailoring of diagnostic strategies, the monitoring-analysis-assessment of process operations, are similar to those employed in other areas, such as the design of control systems. Therefore, an educational and cultural exchange between the two groups (i.e. the control systems design community on the one hand, and the community of people with interests in process operations monitoring, analysis, diagnosis, planning/scheduling) is not only feasible but it is dictated by the real-world needs, which do not subscribe to artificial delineations.

Message 3: The diversity of issues and multi-objective character of the operational problems, encountered in the chemical processing industries require imaginative approaches for the real-world implementation of existing technologies. Such approaches will not only bring together technical people with diverse, inter-disciplinary skills, but they will also integrate the management of human and financial resources with the implementation of novel technical solutions. Future conferences should include these considerations more explicitly in their program. Failure to do so will limit the widespread applicability of tested and effective technologies in Process Supervision and Fault Diagnosis.

George Stephanopoulos, IPC Chairman
Prasad Dhurjati, NOC Chairman

Preview

Keynote paper

The Self-Validating Sensor: Rationale, Definitions and Examples
(M.P. Henry and D.W. Clarke)

Papers from the IFAC Workshop on Algorithms and Architectures for Real-Time Control, Seoul, Korea, August 1992

Guest Editor: P.J. Fleming

Preface to the Papers from the IFAC Workshop on Algorithms and Architectures for Real-Time Control

(P.J. Fleming)

Contemporary Computers Considered Inappropriate for Real-Time Control
(W.A. Halang)

Hard Deadlines in Real-Time Control Systems

(K.G. Shin and H. Kim)

Safe, Fault-Tolerant and Deterministic Algorithms for Real-Time Control
(P.R. Croll)

Parallel Algorithms for Control

(G.W. Irwin)

Real-Time Control of a Multiple Arm System by Large Scale Multiprocessing

(T. Hoshino and K. Furuta)

A Modular, Massively Parallel Computer Architecture for Trainable Real-Time Control Systems

(K. Nilsson, B. Svensson and P-A. Wiberg)

Implementation of a Parallel Algorithm for Event Driven Programmable Controllers

(J. Park, N. Chang, G. S. Rho and W.H. Kwon)

A Real-Time 3-D Acoustic Noise Attenuation System

(W. K. Yung and K.F. Man)

On-Line Subspace System Identification

(Y.M. Cho, G. Xu and T. Kailath)

An Object-Oriented Concept for Real-Time Control of an FMS

(J. Fogel and J. Sebestyeno)

General Papers

Automatic Tuning and Adaptation for PID Controllers - A Survey

(K.J. Åström, T. Hägglund, C.C. Hang and W.K. Ho)

An Experimental Study of Robotic Modelling and Control Using a Fuzzy Neural Network

(H.Y. Xu and G. Vukovich)

Abstracts

Book Reviews

Conference Calendar

This Newsletter may be reproduced in whole or in part. We encourage reprinting in national and local automatic control periodicals. Acknowledgement to IFAC would be appreciated.

Papers From the Next Issue – September 1993

IFAC-IEEE Special Issue on

Meeting the Challenge of Computer Science in the Industrial Applications of Control

Guest Editors: **A. Benveniste and K. J. Åström**

Introduction

(H. Kwakernaak)

Meeting the Challenge of Computer Science in the Industrial Applications of Control: An Introductory Discussion to the Special Issue

(A. Benveniste, K. J. Åström)

Real-Time Expert Systems: Implementation at Monsanto-Krummrich

(L. Thompson, G. Mertz)

Digital Control in Iron and Steel Making Processes

(T. Harakawa, T. Kawaguchi)

Hydropower Reservoir Level Control - A Case Study

(A. H. Glattfelder, L. Huser)

Applied Mathematics in Water Supply Network Management

(P. Carpentier, G. Cohen)

Industrial Applications of Model Based Predictive Control

(J. Richalet)

Application of Statistical Fault Detection Algorithms to Navigation Systems Monitoring

(I. Nikiforov, V. Varavva, V. Kireichikov)

Integrated Modelling and Controller Design With Application to Flexible Structure Control

(K. Liu, R. E. Skelton)

Regular Papers (not part of the Special Issue)

Intelligent Actuators - Ways to Autonomous Actuating Systems

(R. Isermann, U. Raab)

Automatic Tuning of Digital Controllers With Applications to HVAC Plants

(K. J. Åström, T. Hägglund, A. Wallenborg)

Brief Paper

EMS Control System Design for a Meglev Vehicle - A Critical System

(J.F. Whidborne)

Impressum:

Medieninhaber und Herausgeber:

International Federation of Automatic Control (IFAC),

Zürich

Schlossplatz 12, A-2361 Laxenburg, Austria

Verlagsort und Redaktion:

Dipl.-Ing. Dr. Gusztáv Hencsey

Schlossplatz 12, A-2361 Laxenburg

Hersteller:

Artur Scheffczyk & Sohn

August-Reuss-Gasse, A-1130 Wien

Editor: Gusztáv Hencsey

Layout: Ernestine Rudas

published bimonthly

Control Applications of Optimization Automation in Mining, Mineral and Metal Processing IFAC Workshop (9th) Munich, Germany

2 – 4 September, 1992

This Workshop was organized by the Control Engineering Laboratory of the Department of Mechanical Engineering of the Fachhochschule Munich. The meeting was attended by 85 participants from 17 countries; 11 participants came from Eastern Europe.

The International Program Committee (Chairman R. Bulirsch) invited 6 speakers, organized one mini-symposium and accepted 45 contributed papers. Of the resulting 56 lectures 46 were actually given. Visa problems and the lack of travelling funds prevented the participation of 10 speakers.

The invited speakers reviewed the state-of-the-art of their respective topics:

- J.T. Betts, Seattle: Issues in the Direct Transcription of Optimal Control Problems to Sparse Nonlinear Programs
- F.L. Chernousko, Moscow: Optimization in Control of Robots
- F.H. Clarke, Montreal: A Survey on Nonsmooth Analysis and its Applications
- P.E. Gill, San Diego: Large-Scale SQP Methods and their Application in Trajectory Optimization
- G. Grübel, Oberpfaffenhofen: A Coherent Technology for Optimization-Based Control System Design
- J. Pesch, Munich: Solving Optimal Control Problems of High Complexity
- E. Sachs, Trier: Newton-Type Methods for Optimal Control

In devising algorithms for the solution of complicated optimal control problems, two main directions are followed: Shooting techniques and direct transcription of the underlying dynamic system. Both lead to special large systems of nonlinear equations and nonlinear optimization problems with special sparseness structure, respectively. Efficient and robust algorithms based on linearization and using techniques of sparse numerical linear algebra were presented.

Three main topics governed the technical sessions, of which some had to be held in parallel:

- (a) SQP-Based Methods
- (b) Feedback Systems
- (c) Maximum Principle
- (d) Nonsmooth Systems
- (a) Aerospace Systems
- (b) Control of Robots
- (c) Mechanical Systems
- (d) Power Systems
- (e) Games and Uncertain Systems
- (a) Software for Control System Design
- (b) Semisymbolic Algorithms

Efficient numerical implementations of solution algorithms for smooth optimization problems use gradient information of the inherent functions. In the past, the partial derivatives have either been gained by differencing schemes or by integration of sensitivity functions. Both methods are either inefficient or error-prone. Therefore symbolic gradient generation techniques are proposed, based on general purpose software, like Maple or Mathematica, or on special symbolic techniques, using JakeF or the macro-capability of TEX. Symbolic algorithms are also increasingly used in modelling complicated systems.

A special session was dedicated to scientific publication, in which R. Schöpf, Berlin, reported on the Status of the LATEX3 Project. At two meetings held by the members of the IFAC Working Group on Control Applications of Optimization (chairwoman: F. Kirillova) together with the IPC, further activities and publication of proceedings were discussed.

The next Workshop is planned for 1994 in Israel.

Automation in Mining, Mineral and Metal Processing IFAC Symposium

Beijing, China, P.R.

26 – 28 August, 1992

This Symposium was the 7th in a series of IFAC and was held in Beijing, China, P.R. and organized by the Chinese Association of Automation and the Automation Research Institute of the Ministry of the Metallurgical Industry, with the support of the National Natural Science Foundation of China. The theme of the Symposium was the exchange of ideas and approaches relating to the latest development of factory automation in mining, mineral and metal processing as well as the promotion of friendship between specialists in the IFAC family.

The International Program Committee consisted of 29 members from 15 countries. A total of 101 full papers were submitted, from which a selection of 76 papers was included in the technical program, covering the following topics:

- Summarizing papers on the automation of mineral processes; automation in the iron and steel industries in the USA; sensor technology; artificial intelligence techniques.
- Mining and mineral automation
- Blast furnace automation
- Steel making automation
- Rolling automation
- MIS & CIMS in steel industry
- Measuring

Most papers illustrated applications or were application-oriented.

The Symposium gathered 122 participants coming from 13 countries. Four summarizing papers were presented in the plenary sessions, the others in three parallel sessions. The application of artificial intelligence techniques in industrial automation was of particular interest, with about 20 % of the papers dealing with this topic. Owing to the long history of the metallurgical industries, many plants require modernization, thus putting great emphasis on automation. The papers at the Symposium reflected these reforms and developments in metallurgical plants with new control systems, management systems, measuring techniques, etc.

The three-day program was rather impressive, two and a half days were dedicated to plenary papers and parallel sessions, one half day was earmarked for technical visits to the Shoudu Iron and Steel Corporation and to the Automation Research Institute of the Ministry of the Metallurgical Industry.

Chen Zhen-Yu, Vice-Chairman, IPC

LAST CALL

Issues 2 and 3 of the Newsletter this year conducted a Newsletter Survey and confirmation of Affiliate Membership. In one of the next issues of the Newsletter, we shall present an evaluation of the results of the survey. We should like to thank all those who participated for their remarks, suggestions, criticism and – sometimes – also praise.

For those who have not replied until the deadline given, i.e. June 30, 1993, this will be the last Newsletter they receive, unless they send us a confirmation by return mail.