Contents:

25 Years of Automatica

Professor B.D.O. Anderson, President Elect of IFAC has accompanied Automatica as an editor from its very beginning as official IFAC Journal. He contributed the following article, highlighting the development and success of the Journal.

Automatica was once a little journal. I had perhaps looked at it in total some two or three times, when a letter arrived from George Axelby, almost twenty years ago, inviting me to become associated with the new-image Automatica as an Associate Editor.

What were the components of the new image? One of the key features was the coupling with IFAC, through the concept that the best of the IFAC Symposia papers would find their way into Automatica, with Automatica having a first right of refusal of the papers; this was a consequence of the far-thinking agreement struck between IFAC and Pergamon. A second key-feature was the selection of George Axelby as Editor; George had turned the IEEE Transactions on Automatic Control into the leading journal in the world on control, and it was a real coup for IFAC to secure the services of George. Going along with this was a top level commitment from Pergamon to make Automatica a flagship journal, in a scholarly sense and to assist that the physical production became very considerably enhanced.

What has been the end result? Before answering such a question, I should declare my self-interest - I remained associated with Automatica until 1984, when I resigned from my position of Editor, with George Axelby then Editor-in-Chief, in anticipation of becoming a Vice-President of IFAC. My view is, quite firmly, that Automatica is the best all-round control journal in the world. It is wide-ranging in scope, while achieving quality in what it publishes. Like IFAC itself, it has been adaptive to the evolving directions of the control engineering discipline.

One of the operational aspects of Automatica which works particularly well is the interaction with authors, and I say this as a comparatively regular author. George is insistent (always politely - that being George's hallmark) that editors or associate editors be punctual; decisions are neither rushed nor the subject of a debate during infrequently scheduled meetings. Precision of expression is insisted upon in dealing with authors. So authors know where they stand, in terms of timing and expectations of them.

George has been one of the longest serving members of the IFAC community, and is probably the longest serving in the one position. Mere longevity of service is a poor basis for congratulation and the earning of gratitude. The stature of Automatica today, a consequence of the unremitting dedication of George, is the real reason why we thank him.

G.S. Axelby

Letter from the President

Dear George,

Automatica is 25 years old. For 20 years it has been the official journal of IFAC, with you, dear George, its Editor-in-Chief all these years.

While several other scientific journals have experienced periods of serious decline and diminishing circulation during these twenty years, Automatica has thrived, first of all thanks to your efforts. Together with the Associate Editors and the panel of reviewers you have succeeded in keeping up the most up-dated scope and high technical standards of the papers. Automatica is highly esteemed by control engineers all over the world.

On behalf of IFAC, allow me to pass you the sincerest congratulations and wish you a continuing success in the future.
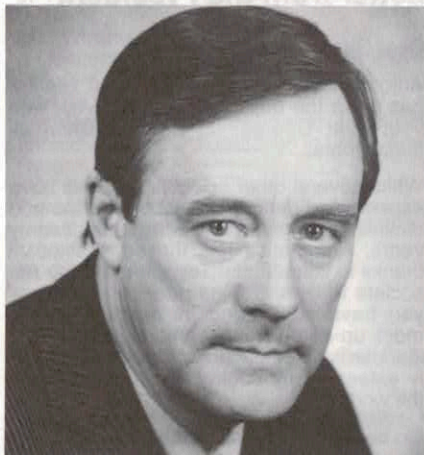
Boris Tamm

Season's Greetings to all our readers

Artificial Intelligence in Real-Time Control
IFAC Workshop
Swansea, UK, 21-23 September, 1988

The first Workshop ever to be held on the subject of Application of Artificial Intelligence in Real-Time Control took place in Swansea, Wales, September this year. For some years, IFAC had been aware of the need to look closely at the important issues being raised in the introduction of AI techniques into the Real-Time Control world, and the decision was made, after the Munich World Congress in 1987, to take the plunge and set up this pioneering event. With some concern and hesitation, the local organizers - the UK Automation Council - sent out a world-wide Call for Papers, and were astounded by the response, which left the International Program Committee (chaired by Dr. Greg Suski and Jim Nevins) the unenviable task of sorting out approximately 16 papers from over 100 which had been submitted. In addtion, the Organizing Committee had, at a very early stage, committed itself to inviting a series of papers in order to ensure sufficient breadth in the event. With this large number of submissions, and despite IFAC's intention to keep its Workshops down to approximately 60 delegates, the organizers had to relent in this case, and allow over 100 chosen delegates to attend - drawn from over 20 major IFAC nations. There can be little doubt that IFAC had been justified in setting up shop in this very important area.

The Organizing Committee was very specific, however, in its intention to present only papers which attacked those specific issues directly affecting Real-Time Control. In addition, because it was a Computer Committee event, the brief was to focus firmly on the fundamental aspects of the technology, and not to look too broadly at applications. To set the tone along those lines, two keynote papers were presented - each drawing on the experience of a major European group active in this area.

In the first keynote, Hans Voss of the GMD in the Federal Republic of Germany, discussed architectural issues for expert systems in Real-Time Control. In this paper, Dr. Voss showed that the particular requirements imposed on the functionality and architecture of expert systems support, or in most cases extend, conventional control systems. The paper discussed the necessity for Deep-Modelling Temporal Reasoning and Maintenance Techniques from an architectural point of view in this new breed of systems. He also argued that it is extremely important to have distributed architectures, so that the expert system and the mediating modules consist of parallel processors. The paper drew on the extensive experience gained in Germany from a government-sponsored venture through the Ministry for Research and Technology, known as TEX-1 Project

Bill Simmonds of SIRA in the UK presented the second keynote address and based his observations on a series of practical installations which his organization had undertaken with the support of the British Government, and in collaboration with various industries in that country. In particular, Mr. Simmonds discussed the problem of representing Knowledge and Reasoning, and the problems encountered in obtaining such information. Bill Simmonds concluded by pointing out that the technology of AI in Real-Time Control is still developing rapidly, and that a new so-called "second generation" of systems is emerging, aimed at overcoming the limitations exhibited by earlier systems. These second-generation systems attempt to use richer knowledge representation and advanced reasoning methods. The key, however, was acquiring the knowledge in the first place.

The other papers presented at this Workshop were representative of the major research bodies active throughout the world in the application of AI techniques in Real-Time

Control with, inevitably, the work of the European group being highlighted. The papers discussed topics such as:
- Architectures for Expert System Based Field-Based Control
- Representation of Inexact Engineering Knowledge about Real-Time Control
- The Automation of Knowledge Acquisition Tasks
- Knowledge-Based Fuzzy Motion Control of Autonomous Vehicles
- AI Based Controllers for Dynamic Systems
- Real-Time AI for Process Monitoring and Control
- An Expert System for Industrial Process Identification
- Design Issues and Knowledge Representation for Control Room Interfaces
- Adaptation to Noise

The Workshop was notable, not only for the high quality of the presentations, but also for the very active participation by attendees. Although AI is still in the process of establishing itself, it is undoubtedly a major new area of engineering endeavour. Practical experience is still relatively limited, and many of the results which were discussed at this event had been obtained through simulation or, in certain cases, from very limited practical experience. The importance, though, lies in the fact that many countries are clearly pouring extensive resources into attempts to control particularly difficult processes by using AI techniques. The wide cross-section of interest was demonstrated by the fact that many diverse industries were represented at the Workshop, ranging from Power System Control, through Telecommunications into the Steel Industry.

The proceedings of this historic IFAC event will be obtainable, very shortly, from Pergamon Press in Oxford, UK.

M.G. Rodd, NOC Chairman

IFAC President Honoured

Boris Tamm

The Council of Helsinki Technical University adopted the decision to award an Honorary Doctor's degree to the IFAC President, Prof. B. Tamm. The awarding ceremony took place on 9 September, 1988.

Distributed Intelligence Systems Methods and Applications
IFAC/IMACS/IFIP Symposium
Varna, BG, June 27 - July 1, 1988

DIS '88, the first International IFAC Symposium on Distributed Intelligence Systems, Methods and Applications, attracted sixty foreign participants from 14 countries. All in all 260 specialists interested in the fields of control systems, artificial intelligence, computer and communication systems attended the symposium, which was organized by Prof. S. Markov, the Honorary President of the National Organizing Committee of DIS '88. The scope of the Symposium, as stated in the final program, was to present the state of the art and recent developments of the systems with distributed intelligence, to discuss the various methods and applications and to provide a useful exchange between theory and practice. The Symposium was held in Varna, right at the Black Sea coast, within a very pleasant environment. In the course of the Symposium 15 invited papers and 45 contributed papers were presented. The plenary sessions with S. Markov (BG), A. Levis (USA), E Yacubaitis (USSR), the round table and closing session with M. Thoma (FRG) and A. Kalaev (USSR) together with five invited sessions were well attended. Proceedings will be published by Pergamon Press.

H. Nour Eldin, IPC Chairman

Control Applications of Non-Linear Programming
IFAC Workshop
Tbilisi, USSR, 21 - 25 June, 1988

The 7th IFAC Workshop in this field was held at Tbilisi, USSR, from June 21 - 25. There were 105 participants, 25 of them from outside the USSR from nine different countries.

Altogether 65 papers were presented (42 contributed, 8 plenary, 15 poster). Prof. F. Kirillova was chairwoman of the International Program Committee, Prof. Salukvadze headed the National Organizing Committee. The technical highlights of the meeting were presentations by USSR scientists: Prof. Gabasov on the solution of nonlinear extremal problems, Prof. Evtushenko on optimization of discontinuous systems and by several other well known scientists. The meeting focused on recent mathematical developments in control, not so much on applications. The workshop was characterized by a lot of technical discussions on optimization theory and numerical methods. All participants felt the warm hospitality of the Georgian people, admired the beautiful town of Tbilisi and the surrounding area and appreciated the historical landmarks.

K. H. Well
on behalf of the IPC chairman

Strategic Plans of IFAC Technical Committees
APCOM Working Groups

Following the detailed description of the IFAC TC on Applications given in Newsletter issue 5/88 as part of the series "Strategic Plans of IFAC Technical Committees", this issue features a description of aims and scopes of the APCOM Working Groups. A comparison of these scopes with the ones given in Newsletter issue 6/85 will show the ongoing developments and changes in some fields of applications requiring constant adaptation of scopes and activities of existing Working Groups as well as the installation of new ones in order to stay at the cutting edge of developments.

1. WG on Chemical Process Control
This Working Groups aims at organizing meetings about control and dynamics in the applications area of chemical, biochemical (fermentation, sewage treatment,...) oil and petroleum, polymer, pulp and paper plants.

2. WG on Electric Generating Plants
Electric generating plants are a class of very complex processes where today the impact of automation is considered of increasing relevance for different reasons:
- as a basic means to enhance power stations and system security, to allow more flexible operation and repeatability of plant manoeuvres;
- as the natural way to substitute human work in routine operations, particularly to reduce the shift personnel at night hours;
- to achieve more precise control of process variables and, therefore, a better tradeoff between efficiency and plant life;
- to cope with the new requirements to power plant operation raised by the shortage of modulating power in large power systems.

The relevance of the specific application field is clearly demonstrated by the large amount of capital investments involved in the automation of large power units, because of the strategic role of the economic exploitation of energy and the enormous return obtained from (even limited) improvements of energy conversion processes.

The introduction of new technologies and methods based on microcomputers is not straightforward in that security aspects and control reliability are very stringent for this kind of plants, especially for large nuclear and fossil fired power stations. The application of new control concepts generally requires an extensive validation work to identify possibly weak points, to gain confidence in their use and to make them acceptable to the operating personnel.

The above considerations widely justify the huge effort of manufacturers and utilities to gradually move toward fully automated operation of large power plants.

Most important subjects of research are therefore:
- Development of accurate and usable modelling and simulation codes to predict the behaviour of electric generating plants in the most critical conditions and to test control system behaviour in such circumstances;
- Evaluation of actual improvements achievable by using new control technologies and concepts;
- Analysis of advanced solutions in man-machine interfaces able to supply prompt and selected information to plant operators in most critical (incidental) contingencies;
- Design of plant simulators to support engineering assessment and operators' training;
- Application of integrated design concept to process and automation designs, especially for new electric generating processes.
The interdisciplinary character of the above research subjects can naturally be considered within IFAC where system approach, dynamic simulation and automatic control concepts are comprehensively developed and applied.

Therefore the scope of the Working Group is to supply the opportunity, to experts coming from different experiences and frameworks, of discussing in a unifying system approach the most interesting innovations currently proposed and applied to modern power stations. Symposia and Workshops specifically devoted to this subject seem to be necessary to deal with the actual problems raised by real-size applications and to stimulate the participation of industrial research representatives. On the other hand, the rather cautious behaviour at electric utilities and of manufacturers when considering the application of new control technologies to such complex plants should properly be stimulated by the presentation and diffusion of real innovative applications which require adequate discussion of most practical aspects.

Due to the many pecularities of the involved processes, control applications to electric generating plants require a separate consideration and no significant practical improvement can be achieved without a suitable analysis of the process features and of the actual plant constraints.

Of special concern is the interaction between electric generating plants and power systems, which has to be considered by keeping the actual requirements and constraints of the two sides in the real operation. The latter topic will suitably be dealt with in cooperation of this WG with the one on Power Systems.

3. WG on Electric Power Systems
Scopes and aim of the Working Group are described below:
- To foster international exchange of information and experience on applications of control engineering, systems science and computer science to the design, operation and automation of electric power systems;
- To promote sponsorship or co-sponsorship by the Applications Committee of international workshops and symposia dealing with system-oriented and knowledge-based problems of electric power systems.
- To participate through its membership in the technical reviews of papers submitted for presentation at workshops, conferences, symposia and the World Congress which deal with subjects within the scope of the Working Group.

- Applications of large-scale systems analysis, optimization, identification, estimation and control to power systems.
- Applications of artificial intelligence and pattern recognition techniques and of knowledge-based systems to planning and operation.
- On-line operation methodologies
- Operation planning methodologies
- Integration of system planning with system operation
- Stability analysis and control techniques
- Methods of system protection
- Hierarchical control system design
- Theory and application of security control for normal, emergency and restorative states of power system operation
- Computer networks in power systems
- Design and implementation of real-time computer control hardware and software systems for power system operation
- Man-machine interfaces and human factors in the design of power system control systems
- Multi-level decomposition and coordination of monitoring and control functions

- Coordination of local control functions at substations and power plants with system control functions at the control center
- Training simulators for power system operators.

4. WG on Mining, Mineral and Metal Processing
The aim of the Working Group is to provide a forum for discussion on measurement, automation and optimization, based on control theory, to enhance the understanding of measurements for process control in the fields of mining and of mineral and metal processing. The area of activity of this Working Group also includes the exploration and exploitation of organic material such as coal, gas and oil, but it excludes the refining of these materials since this specialized field is covered by the Group on Chemical Process Control.

5. WG on Automatic Control Applications in Agriculture
The aim of this Working Group is to provide a platform for discussion on - and to provide a confrontation between theory and practice of - Control Applications in agriculture in the areas of:
- environmental control (greenhouses, vegetable factory, animal houses and bio-reactors, etc.)
- identification and control of bio-technological and physiological-ecological processes (bio-reactors, bio-nursery systems and plant factory, etc.)
- computer networks and signal processing (agro/bio-data-bases, AI and expert systems for agriculture, LAN for greenhouses and plant factory, etc.)
- instrumentation (image, bio, ion and intelligent sensors for agriculture)
- mechanical systems (optimization, CAD/CAM and computer integration for agricultural machinery and post harvest technology, etc.)

with direct links to areas that are already covered by other IFAC Technical Committees and Working Groups, such as Management Systems, Hydrology (rainfall, runoff systems) and Environmental Control (wastewater treatment)

This can be realized via:
- organization of special sessions at relevant IFAC Symposia
- organization of workshops by the main sponsor of IFAC/APCOM
- promotion of publications on agricultural subjects in scientific journals in the field of control science
- co-sponsoring agricultural professional organizations (for example contacts have already been made with the Commission for Horticultural Engineering of the International Society for Horticultural Science (ISHS) and the Working Groups of Agricultural Mechanical Systems in the Japanese Society of Instruments and Control Engineers (SICE)
- establishing an informal network for exchange of research results, students, publications, etc.

6. WG on Automatic Control Applications in Marine Systems
The aim of this Working Group is to provide a forum within IFAC to promote control applications in marine systems. These include:
- offshore exploration vessels and installations
- underwater devices
- deepsea mining systems
- devices for arctic use
- vessels for specialized marine services

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Papers from the Next Issue - Jan. 1989

Papers

A Dual Rate Adaptive Digital Smith Predictor
(C.C. Hang, K.W. Lim, B.W. Chong)
Real-Time Control of a Non-Linear Electromagnetic Actuator
(S.A. Hall)
Comparison of an Auto-Tuned PID Regulator and an Adaptive Predictive Control System on an Industrial Bleach Plant
(G.A. Dumont, J.M. Martin-Sanchez, C.C. Zervos)
Relationship Between Internal Model Control and LQG Controller Structures
(M.J. Grimble, S. De La Salle, D. Ho)
Measurement Selection for Linear Multivariable Control Systems
(D. Gosh, C.H. Knapp)
Steering Control for Singularly Perturbed Systems: A Composite Control Approach
(H.K. Khalil, Y.-N. Hu)
A Hierarchical Decomposition for Large Scale Optimal Control Problems with Parallel Processing Structure
(S.-C. Chang, T.-S. Chang, P.B. Luh)
Properties of the Parametrization of Monic ARMA Systems
(M. Deistler, M. Gevers)

Brief Papers

Solving Dynamic Optimization Problems on a Personal Computer Using an Electronic Spreadsheet
(M. Parlar)
Adaptive Head Control of a Hydraulic Open Channel Model
(O. Begovich, R. Ortega)
Robustness of Pole Location in Perturbed Systems
(A. Vicino)
Characterization of Robust Regulators
(Y.C. Soh, R.J. Evans)
Robust Performance of Decentralized Control Systems by Independent Design
(S. Skogestad, M. Morari)
Time Varying Feedback for the Stabilization of Fixed Modes in Decentralized Control Systems
(J.L. Willems)
A Concept for Parameter Independent Evaluation of Decentralized Stability
(M. Ulm, H.D. Wend)
Overlapping Vs. Partitioning in Block-Iteration Methods: Application in Large-Scale System Theory
(J.L. Calvet, A. Titli)
Consistent Order Estimation for Linear Stochastic Feedback Control Systems (CARMA Model)
(L. Guo, H.-F. Chen, J.-F. Zhang)

Book Reviews

Stability of Adaptive Systems by B.D.O. Anderson et al.
(P.C. Parks)
Linear Control Systems by M. Jamshidi & M. Malek-Zavarei
(A.P. Sage)

Editor: Gusztáv Hencsey

Layout: Ernestine Rudas

published bimonthly

- ships for merchant transport
- systems and methods for testing and validation

The system control technologies of special interest for marine applications include
- system design for robustness and safety
- performance monitoring and fault diagnosis
- system identification and signal processing
- adaptive and optimal control for e.g. energy optimization
- distributed control for redundancy and safe reversionary operation
- integrated control and surveillance
- system design towards low cost automation

These aims can be realized through
- organization of special sessions at relevant IFAC symposia
- organization of specialist workshops
- promotion of publications on marine systems in the scientific journals on control science
- establishment of informed contracts for exchange of recent results, research student exchange, etc.

Some of the former co-sponsored symposia have had a rather broad scope and have therefore been less attractive. The Working Group will primarily aim at the more specialized events.

New Publication

Proceedings of the IFAC Symposium Automation & Instrumentation for Power Plants

**Bangalore, India
15-17 December 1986**

Editor: M. Ramamoorty,
Central Power Research Institute, Bangalore, India

This volume is part of the IFAC Proceedings Series and presents papers on the following subjects:
An analysis of power systems, control hardware, modelling and simulation, instrumentation, and computers and distributed systems. The stability of plants and their interaction in a multi-machine system will also be discussed, as well as an analysis of the values of LOFT ATWS EVENT for PWR and the new algorithm of on-line ELD for thermal power plants.

pp 360
price available upon request from:

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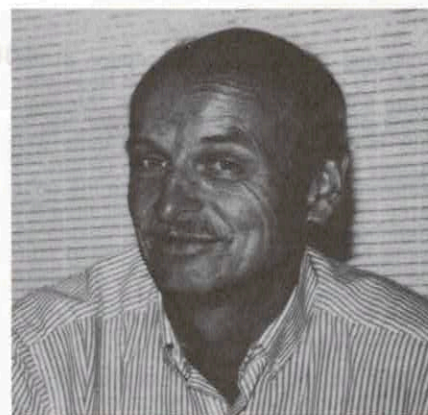Pergamon Press plc
Headington Hill Hall
Oxford OX3 0BW
UK

WHO IS WHO IN IFAC

Dr. T. Martin
Chairman of TC on SOC.EFF.

Thomas Martin was born in Hamburg, FRG in 1936. He received his diploma in mechanical engineering in 1962 from Stuttgart Technical University. During his studies he was awarded World Student Fund and Fulbright Scholarships which made it possible for him to spend one year at the Georgia Institute of Technology in Atlanta, GA where he did graduate studies in automatic control and computer science. Having returned to Stuttgart University he worked as a graduate assistant at the Institute of Applied Hydraulics and Automatic Control. His doctor's thesis on "Pulsating Flow in Visco-Elastic Tubes" was completed in 1967.

After his studies, Dr. Martin joined AEG Telefunken, Process Computer Division, as a unit manager in 1967. He developed process computer monitor and control systems, including large software packages for power plant control and basic software for new process computer models.

As of 1975 Tom Martin has been working on behalf of the German Federal Ministry for Research and Technology, directing national support measures aimed at enhancing the technological standard of machine manufacturers. The present program is called Manufacturing Technologies. It contains projects in the areas of CIM, robotics, quality control, man-machine systems and technology assessment. Within several of these projects, interdisciplinary teams try to anticipate social effects in designing improved production systems. Social effects of automation have thus become part of the daily work of Tom Martin.

Tom Martin's publications include a book on process computer control and various papers in the areas of real-time programming, man-machine systems and social effects of automation. He worked part-time as a lecturer of Real-Time Software Engineering at Stuttgart University from 1978 to 1980.

In IFAC, Tom Martin was vice-chairman of the Technical Committee on Social Effects of Automation from 1984-1987 and was elected Chairman of this Committee for the period 1987-90.

Apart from his technical activities, Tom Martin studied the cello and plays this instrument in chamber music groups and as a member of the Karlsruhe University Symphony Orchestra.