A BRIDGE BETWEEN CONTROL SCIENCE AND TECHNOLOGY

General Editors
J. GERTLER and L. KEVICZKY

Volume 3

LARGE-SCALE SYSTEMS, DECISION-MAKING, MATHEMATICS OF CONTROL

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1984

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1985

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(*Ninth Triennial World Congress*)
No. 7 BILLINGS & YOUNG: Identification and System Parameter Estimation (1985)

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A BRIDGE BETWEEN CONTROL SCIENCE AND TECHNOLOGY

NINTH TRIENNIAL WORLD CONGRESS OF IFAC

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PREFACE

The triennial World Congresses have always been the main events of the International Federation of Automatic Control. While symposia and workshops concentrate on specific technical areas, IFAC Congresses present a broad view on the state of the art and development trends in the entire field of automatic control and systems engineering, embracing both theory and applications. This tradition, established with the first IFAC Congress in Moscow in 1960, has been maintained and further advanced during the two decades that followed, a period marked by congresses in Basle, London, Warsaw, Paris, Boston, Helsinki and Kyoto. A look at the subjects covered at those congresses gives a good indication of the tremendous evolution our profession has gone through, from theory, components and industrial applications at the beginning to a multitude of new areas, ranging from mathematics of control, systems engineering and computers through applications in manufacturing, space and biomedical engineering and including such fields as economic and management systems, social effects of automation and developing countries.

The intention of the planners and organizers of the 1984 Budapest Congress was to keep these traditions and alloy them with some innovations in the technical programme. The broad approach to the entirety of the profession has been maintained, as well as Plenary Papers, Paper Sessions, Case Studies and Discussion Sessions as the main components of the technical programme. At the same time, the Paper Sessions were given more structure and the Technical Committees of IFAC a greater role in their organization. Discussion Sessions received more emphasis and new Industrial Problem Sessions were introduced into the programme.

Six subjects were selected for Plenary Lectures, each representing an area of major interest and present thrust in automatic control. Outstanding experts were invited to present broad and synthetizing views on each subject. These six lectures were meant to be the main focal points of the technical programme, an objective completely fulfilled by each of them. The six Plenaries, together with their authors, are as follows:

Development of systems science: Past, present and future. (J. Zaborszky)
Control theory in the 80s: Trends in feedback design (P.V. Kokotovic)
Incentives and control in economic organizations (R. Radner)
Process control and information systems (G. Färber)
Flexible manufacturing systems in Japan (H. Yoshikawa)
Control in and for biosystems (V.A. Viktorov, V.N. Novoseltsev, V.I. Shumakov)

The technical papers were arranged into 37 Congress Colloquia, each Colloquium dealing with a particular area or aspect of automatic control and systems engineering. The titles of the Colloquia were proposed by the Technical Committees of IFAC and their programme was shaped by separate Colloquium International Programme Committees set up by the Technical Committees. These Colloquium IPCs invited papers, reviewed the contributed ones and decided upon their acceptance and they arranged the accepted papers into Paper Sessions, within the general framework determined by the Congress IPC. The more than 150 activists working in the Colloquium IPCs and, especially, the chairmen of these committees, made a most substantial contribution to the Congress programme.

The 37 Colloquium titles are listed below, each with the primary organizer Technical Committee and the name of the IPC Chairman:

Control of power stations and systems (Applications, T.E. Dy Liacco)
Automatic control for the utilization of energy and materials (Applications, M.A. Pai)
Industrial process control (Applications, E.A. Nisenfeld)
Neur -control of motor functions (Biomed., G. Vossius)
Control of artificial organs (Biomed., H.R. Weed)
Control of assistive devices for paralyzed patients (Biomed., J. Reswick)
Control in endocrine-metabolic systems (Biomed., C. Cobelli)
Programmable and intelligent components and instruments in automatic control (Components, H.J. Leskiewicz)
Tools for software system design and integration (Computers, M.H. Paul)
Communications for real-time computer control (Computers, T.J. Harrison)
Safety of real-time computer systems (Computers, W.F. Ehrenberger)
Microcomputer-based control (Computers, D. Tabak)
System approach to development (Developing Countries, M. Najim)
Modelling, economic analysis and strategic planning of energy systems (Economic and Management Systems, Y. Kaya)
Trends in automatic control education (Education, M.P. Larsen)
Flexible automation in manufacturing (Manufact., U. Rembold)
Robotics (Manufact., K.G. Kempf)

Computer aided engineering in manufacturing (Manufact., D.R. Towill)
Mathematical systems theory (Math. of Control, M.L.J. Hautus)
Control applications of non-linear programming (Math. of Control, H.E. Rauch)
Team and game theory (Math. of Control, M. Pachter)
Asymptotic analysis and singular perturbation (Math. of Control, P.V. Kokotovic)
Social aspects of CAD/CAM and robotics (Social Effects, L. Martensson)
Large-scale systems: theory, methodology and non-standard applications (Systems Eng., A. Titli)
Computer aided system analysis and design (Systems Eng., G.G. Leininger)
Industrial systems engineering (Systems Eng., I. Lefkowitz)
Man-machine systems (Systems Eng., G. Johannsen)
Application of large-scale techniques to human decision making and management (Systems Eng., M.G. Singh)
Transportation systems (Systems Eng., R.E. Fenton)
Process design and control for preventing environmental pollution (Systems Eng., T. Takamatsu)
Water resources systems (Systems Eng., Y.Y. Haimes)
Supplemental ways of improving international stability (Systems Eng., H. Chestnut)
Space applications (Space, D.B. DeBra)
Modelling and identification (Theory, L. Ljung)
Synthesis of control systems (Theory, A.G.J. MacFarlane)
Structural properties and analysis of control systems (Theory, W.R. Perkins)
Adaptive and stochastic control (Theory, K.J. Åström)

A total of more than a thousand draft papers were submitted by authors from 37 countries, of which 569 were accepted and 544 were actually received in final form and presented at the Congress.

Responding to a general demand for extended discussion opportunities, 38 Panel Discussion Sessions were organized, much more than at any previous congress. A significant portion of these Panel Discussions dealt with not strictly technical subjects, such as "The impact of culture on automation", "Management and education for world complexity" or "Computer aided design in control education". A special series of 11 Industrial Problem Sessions was devoted to problems like "Mill-wide control in the paper and pulp industry", "Production management of small orders in steel mills" or "How to interface human factors in automation projects".

Seven Case Studies were also presented, five of them reporting on results of the Hungarian hosts in education, nuclear power plant control, computer controlled manufacturing and computer application in agriculture and health-care.

The six volumes of the Proceedings contain the complete technical material of the Congress. The 544 technical papers are published in their original colloquium arrangement, related subject areas combined in each volume. The Colloquium IPC Chairmen have served as Editors of the respective volume and the full Colloquium IPCs are listed as well. Each volume starts with one of the six Plenary Lectures, the one most closely related to the rest of the volume. Summary reports on 32 of the Discussion Sessions, including a full account on the Industrial Problem Sessions, are also published, together with the entire material of the Case Studies. These reports are also distributed among the six volumes, according to their subject areas. The discussions that followed the presentation of papers in the technical sessions are not included, because this eventual and uneven material did not seem to justify the substantial effort and publications delay its editing would have implied.

We do hope that the publication of this material will render a useful service to the world-wide community of control and systems engineers and will further the realization of the Congress objective of broadening the bridge between Control Science and Technology.

Janos Gertler
Chairman, Congress IPC

CONTENTS OF VOLUMES 1–6

VOLUME 1

Contents of Volume 1

Contents of Volume 1

Contents of Volume 1

Contents of Volume 1

COLLOQUIUM ON COMPUTER AIDED SYSTEM ANALYSIS AND DESIGN

Contents of Volume 1

VOLUME 2

PLENARY PAPER

COLLOQUIUM ON MODELLING AND IDENTIFICATION

Identification Theory

Identification Methods

Recursive Identification

Contents of Volume 2

COLLOQUIUM ON ADAPTIVE AND STOCHASTIC CONTROL

Estimation and Filtering

Contents of Volume 2

Contents of Volume 2