Information Control Problems in Manufacturing Technology 1989

INFORMATION CONTROL PROBLEMS IN MANUFACTURING TECHNOLOGY 1989

Selected papers from the 6th IFAC/IFIP/IFORS/IMACS Symposium Madrid, Spain, 26–29 September 1989

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PREFACE

This volume contains the papers presented in the 6th IFAC/IFIP/IMACS/IFORS Symposium on Information Control Problems in Manufacturing Technology which helds in Madrid (Spain) on September 26-29, 1989.

This aim of the Symposium is to present, discuss, and summarize research on new theories, as well as advanced applications of automatic systems in Computer Integrated Manufacturing (CIM). This Symposium is the main MANTECH-IFAC event and follows the 4th and 5th symposia held in Maryland (USA) in 1982 and Suzdal (USSR) in 1986.

A total of 110 papers were presented given in 48 sessions, covering the following topics:

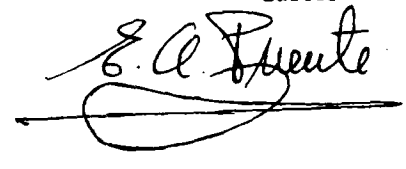
- General aspects of CIM
- System management and planning
- Simulation of manufacturing processes
- Control problems
- Manufacturing networks
- Al and Expert systems in manufacturing
- Information system for manufacturing
- Sensor-based robots in manufacturing
- Advanced applications and case studies

In addition to these papers, three plenary sessions presented by invited speakers, covers the theory, methods, applications and future trends in manufacturing technology. Two round tables "Difficulties of introducing the automation in the industry" and "Education in Manufacturing and robotics", took also place during this symposium.

I would like to thanks the members of the International Program Committee for the effort in the selection of papers and the members of the National Organizing Committee for their support in the organization of this event.

I hope that the publication of these papers, which come from experts from 29 countries, will make a good contribution to the development field.

E.A.Puente
Editor



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The Editors

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EDUCATION IN MANUFACTURING AND ROBOTICS

Organizer: P.Kopacek

Panelists: L.Nemes, J.Paiuk, J.Scrimgeour

Introductory statement by P.Kopacek

As frequently pointed out education in CIM and robotics is a very difficult and complex subject. On one hand education in this field requires a lot of a priori knowledge in different fields (e.g. mechanics, electronics, control, computer sciences...) on the other hand those who have to be taught come from different educational levels. Consequently scientists and industrial engineers of various fields have to cooperate for efficient teaching in CIM and robotics.

A first stage providing some general background knowledge enables non specialists to understand the language of specialists and to get a feeling for what CIM components are able to do and what they are not able to do. Therefore some basic knowledge about factory automation must also be provided. One of the aims of CIM and robotics education at this (low, but general) level will be to enable the engineer to make a profound decision about the incorporation of robots and manipulators in a special automation concept.

The next-higher level in CIM education is for a specialist in application. In addition to the knowledge mentioned above for the lower level he will be educated in more detail e.g. in the structure of programming languages, in CAD/CAM, in artificial intelligence, in pattern recognition, safety problems and last not least in social effects and economical considerations.

The highest level includes additional more theoretical background about the topics listed above. The thus educated factory automation specialist has a deep insight in this field as well as in application problems. One very important fact during the education is the connection between theory and practice. Theory and practice should have equal rights in each educational program. This holds also true for all other kinds of education (including continuing education). Laboratory experiments, demonstrations, audiovisual facilities and visits to different factories are absolutely necessary for this goal.

Statement by L.Nemes

Education from the research and development point of view

Research and development activities on Computer Integrated Manufacturing need highly skilled engineers with extensive knowledge on information technology, good understanding of manufacturing processes and with production engineering practice. It is required from these people to work in a multidisciplinary team to solve complex tasks in system design, machine and software research and development etc.

In the early years the Mechanical Engineering Automation Division, Hungarian Academy of Sciences recruited either mechanical engineering or computer science graduates. Although they were the best students in their respective fields, they just had general knowledge on complementary subject areas.

Almost all these students have had some practice in research activities because they have acquired it during their postgraduate courses. Because of degree examinations require individual achivements the students usually work alone on well defined tasks thus they have had little experience how to work, interact in teams.

To be able to hire properly trained engineers upon their graduation a few people from our staff accepted part time teaching jobs at various departments of technical universities. They selected the brightest students, to whom we offered part time jobs in the Division. They have come to work whenever they had time because they were highly motivated to contribute to "real research" to have access to better equipment what they have been offered at the universities.

During their "incubational" periods they had collected knowledge and expertise on necessary fields due to their personalized training program. In most cases they have also participated in factory implementation of R and D results as well.

In every year we re-employed the best students and we invited new ones to replace the drop-outs. Those who managed to maintain good performance for years have had the privilege to be offered a research position in the Division.

Although this activity has been highly successful but the burden on the senior research staff has been significant. It was proposed therefore for the Technical Univerity Budapest to set up a special training program for talented students with interdisciplinary curriculum on the field of integrated manufacturing strait from the first year on. The Hungarian Ministry for Machine Building realized the impact of this education program on the future of the Hungarian production industry and donated an education CIM system for teaching and research purposes.

In other countries similar reseach centers have been established around leading faculties of technical universities so the education has embarked on the road of training new type of experts.

Statement by J.Paiuk

From the viewpoint of an industrial engineer the awareness and consciousness of the importance of economical implications is very important in this field. Especially in the field of factory automation the engineer has to keep in mind the industry's needs in relation to cost/economical implications:

- on time delivery of projects according to expected objectives
- training in both senses for technicians, operators as well as the upper management

By means of automation new technologies can be incorporated in the quickest possible way to any process. Thus professionals in our field have to be convinced of their roles as agents of changes, as educators.

Statement by J.Scrimgeour

Education and Flexible Automation -

An Examination of Need and the IFAC Role

The question before us, this evening, is on the subject of education, and I belief also on the role of IFAC. Perhaps even more specifically we might consider the role of the INCOM seminars as part of the education process.

When we speak of "education", as related to automation, we tend often to limit our thoughts and discussion to the design of curricula at the university level. An attempt will be made to indicate that a much broader view can be taken, which adds another dimension and which adds an even more vital meaning to the concept of education for advanced manufacturing technology.

In his very thoughtful opening remarks for the INCOM '89 seminar, L. Nemes drew attention to the three main elements of the name INCOM. They are information, control and manufacturing. He stressed that information is seldom organized or complete; that control includes management of the process as well as just control; and that the application area for INCOM is manufacturing. In our discussion we can come back to these three areas in a few moments.

First, let us come to the subject of education. We need to remind ourselves that there are at least three education streams for education in computer integrated manufacturing or flexible automation.

There are:

1.University education;

2.Professional personnel employed in the manufacturing industry (engineering and technical personnel); and

3.Management and executive training.

These three education streams represent three distinctly different groups in terms of their membership. They differ greatly in age, background, interests, motivation and outlook.

They also differ substantially in terms of their timing and contribution to the transformation process of industrial automation (as a requirement) and in order of their subsequent contribution, their order is the reverse of the above sequence. Management awareness, education and understanding of CIM and advanced manufactoring technologies must precede any large scale adoption. Professional training, and re-education of the engineering work force already employed and experienced in industry is the second key to a rapid transformation and adoption of new technology. Only then is a demand created for new technical personnel and a work force trained in the new technologies.

One can also ask if IFAC and the INCOM conferences are fulfilling their potential role in this. Is IFAC really involved? If my observation is correct, we do not have a large industrial population attending IFAC conferences for educational purposes.

Is this an information and control problem in manufacturing?

It is a most difficult task, at the chief executive officer level of a company, to develop a deep sense of awareness of CIM or advanced manufacturing technology, its impact on the company and its impact on the organization structure.

Is creating this awareness an information and control problem in manufacturing?

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