● *Preface*

After more than one generation of industrial automation based on computers, the successive euphorias about developments in CAD/CAM, FMS, CIM, AI techniques and MAP have gradually been tempered by the subsequent experiences of lacking the required manufacturing knowledge. Many information scientists have tried to make us believe that their newly developed generic tools were ready, or almost ready, for successful use in industrial applications. However, following the development in performance of computer tools, design and manufaturing engineers have found themselves more and more "left" with two major problems:

1. the specification, formalization and systematization of manufacturing knowledge and the development of decision methods
2. the implementation of this knowledge with the aid of the computer tools.

The problems have eventually led to the conception that the development of software tools has to be carried out hand in hand with the development of better design, process planning, production planning and manufacturing methods.

In recent years, design and manufacturing engineers have developed a new generation of concepts and methods for geometric reasoning, sophisticated product modelling techniques, feature-based design and process planning, manufacturing systems design, production planning and control, which together represent a promising perspective for future integration and large scale automation of manufacturing processes.

This issue contains a selection of the papers which were presented at the MSTF '91 Conference, held on 10-12 June 1991 at the University of Twente in The Netherlands. The major theme of the conference was "Production Engineering and Information Technology". The selected contributions address the areas of design, process planning, production control and manufacturing systems design, which represent major research areas in the field of manufacturing science and technology.

During the opening session of the conference, three general papers were presented on research in the field of production technology and supporting information technology which takes place in the framework of the European ESPRIT and EUREKA programs. These papers reflect, amongst others, the firm belief of European industries and research institutes that research and development in these areas are key factors in world wide industrial competition.

The first technical paper deals with an analysis of user and operator requirements for future developments in CAD/CAM, based on the author's long industrial experience. The next contribution describes the development of intelligent design systems. Meta-level qualitative reasoning is used to model design objects as well as for the manipulation of the design object models. The following paper deals with the development of a CAD system which supports kinematic simulation based on manipulation of 3-D geometrical design objects. The aim is to support designers in the creation of assemblies which are easy to realize. Constraint-based product modeling with default values is discussed as a possible design method for kinematic mechanisms. The use of constraints provides the possibility of working with abstract models and the use of default values facilitates working with incompletely defined product models. Both methods make a straight top-down approach in design possible. Design for manufacture, another important subject, is dealt with in a contribution describing a so-called communication tool which supports cost-effective design of mechanical parts based on cost graphs.

Process planning has become a very popular research item during the last decade. A concise state of the art report is included. One of the most distinctive new developments in process planning as well as in design is the use of features to represent design and manufacturing knowledge. The paper deals with the use of the feature representation method for the planning of machining processes for the manufacture of forging dies, applying special machining processes. Task-level on-line programming of robots is an item in the field of on-line process planning. One of the problems adherent to process planning in small scale production is the assignment of jobs to machine tools. A method of integrating process planning and capacity planning, an item which over the coming years will become of increased interest, is reported. The method is based on the division of the whole process planning cycle into three separate phases, providing the possibility of balancing work loads based on actual workshop data.

A new approach to production planning and control using a knowledge based diagnosis system is presented. The so called "funnel" control method uses a throughput diagram to illustrate the quality achieved in control in comparison with the logistic targets set. A general hierarchical manufacturing plan-

ning and control system for flexible manufacturing systems is discussed, based on arguments such as reduction of complexity, separation of short-, medium- and long-term aspects and last but not least stability. A report of a real-life application is part of the presentation. A real-time control system for production cells based on scheduled workplans is a contribution which combines the aspects of production planning and real-time production activity control. A strongly related subject reports the development of a communication network as an integrated part of a real-time shop floor control system for small batch part manufacturing environments. The latter system, developed under the European ESPRIT program has successfully been implemented in industry.

Manufacturing systems design is addressed in a report on a basic study into a CIM reference architecture. The architecture is represented in a CIM base modeling language and is based on an analysis of previous CIM projects, performed in national and international research programs such as the CAM-I research program and the European ESPRIT research program. Other system design subjects addressed in this issue are the so called control loop architecture, dedicated to the measurement and feedback of both work flow and quality data and the design of cellular manufacturing systems based on a new clustering algorithm.

The program contains many fine examples of research projects challenging key problems on the way to computer integrated manufacturing.

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