SYMBOLIC COMPUTATION

Computer-Aided Design and Manufacturing

Methods and Tools

Second, Revised and Enlarged Edition

Edited by
U. Rembold and R. Dillmann

With 304 Figures

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Introduction

Manufacturing contributes to over 60% of the gross national product of the highly industrialized nations of Europe. The advances in mechanization and automation in manufacturing of international competitors are seriously challenging the market position of the European countries in different areas. Thus it becomes necessary to increase significantly the productivity of European industry. This has prompted many governments to support the development of new automation resources. Good engineers are also needed to develop the required automation tools and to apply these to manufacturing. It is the purpose of this book to discuss new research results in manufacturing with engineers who face the challenge of building tomorrow's factories.

Early automation efforts were centered around mechanical gear-and-cam technology and hardwired electrical control circuits. Because of the decreasing life cycle of most new products and the enormous model diversification, factories cannot be automated efficiently any more by these conventional technologies. With the digital computer, its fast calculation speed and large memory capacity, a new tool was created which can substantially improve the productivity of manufacturing processes. The computer can directly control production and quality assurance functions and adapt itself quickly to changing customer orders and new products. It allows the automation of long and short range forecasting, product design, process planning, production scheduling and manufacturing control. The flow of information through a plant can be monitored and corrective action can easily be initiated if necessary. Probably the most important asset of the computer is its capacity to integrate the entire manufacturing system from product design to fabrication. Its ability to make decisions will contribute to the conception and design of flexible manufacturing systems. With the progress of artificial intelligence activities and with powerful low cost computing equipment, it will be possible to conceive expert systems for manufacturing. Upon entry of a product order they will be able to plan and supervise automatically the production process. This will be realized with the help of decision rules and a knowledge data base about the production process and the available manufacturing resources.

The object of this book is to discuss advanced and future CAD/CAM technologies. Of course, the vast scope of manufacturing cannot be satisfactorily presented in one volume. Thus only those topics which are of common interest to many manufacturing organisations and which appear to be very important in the future are selected. In addition, an attempt is made to present to the reader the computer activities in manufacturing as an entity. For this reason the contents of the book can be used for courses covering this subject.

The following topics are presented:

- Computer Control for Manufacturing Equipment
- Design of Production Control and Flexible Manufacturing Systems
- CAD Systems and their Interface with CAM
- Technological Planning for Manufacture
- Economic Analysis of Manufacturing Systems
- Quality Assurance and Robot Vision
- The Interface of Process Planning with Production and Facility Planning
- Product Design for Assembly
- Production Control and Information Systems
- Programming of Machine Tools and Industrial Robots

This book is based on the lecture notes of the Advanced Course on Computer Integrated Manufacturing (CIM '83), held at the University of Karlsruhe, September 5–16, 1983, Karlsruhe, Federal Republic of Germany. The course was financed by the Ministry of Research and Technology (BMFT) of the Federal Republic of Germany and by the Commission of the European Communities. The course was a continuation of a course on "Computer Aided Design, Modelling, Systems Engineering, CAD-Systems" held at the Technical University of Darmstadt, September 8–19, 1980. The lecture notes were published in 1980 by Springer-Verlag under the same title, and edited by J. Encarnação.

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Karlsruhe, October 1986

Ulrich Rembold
Rüdiger Dillmann

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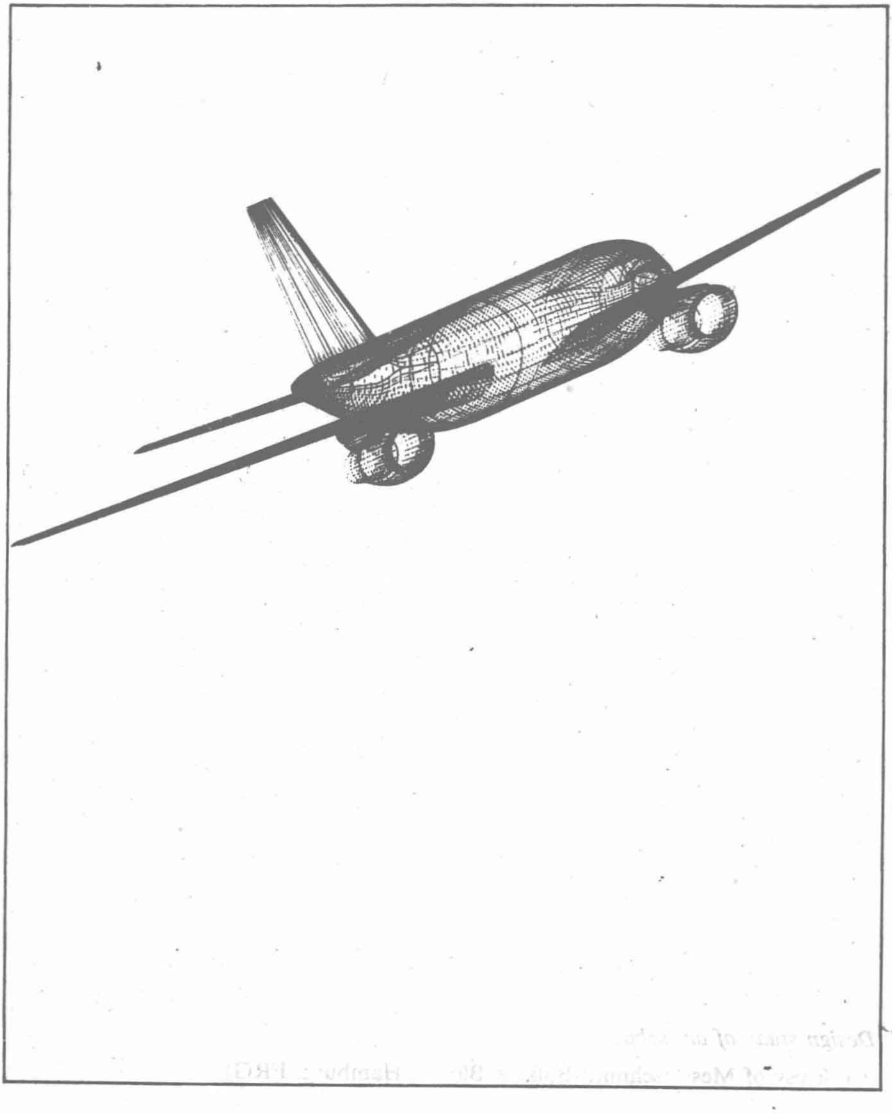
H. Grabowski and R. Anderl



Design study of an airbus

(Courtesy of Messerschmidt-Bölkow-Blohm, Hamburg, FRG)