

Computer-Aided Process Planning

by Hsu-Pin Wang and Jian-Kang Li

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Gabriel Neagu was born in Bucharest in 1949. In 1973 he received his M.Sc. in Control Engineering from the Energetic Institute of Moscow and joined the Research Institute for Informatics in Bucharest. His major Research & Development activities have been related to: complex computer systems for steel industry and aluminium plants, pipe factories, electronic industries; real-time discrete production control systems at the shopfloor level; management information systems at micro- and macroeconomic level. He is author/co-author of some 20 papers, mainly dedicated to industrial informatic systems design. Currently he is senior researcher at the Research Institute for Informatics. He is a candidate to doctoral degree in Applied Informatics. His research interests include knowledge-based production control systems, modelling and qualitative simulation of discrete processes, decision support systems, societal informatics, advanced informatic systems engineering.

The book is devoted to one of the most important topics in the Computer Integrated Manufacturing field. In the authors' intention the book should provide "a rigorous basis for the understanding of process planning and the development of effective and efficient Computer-Aided Process Planning systems".

Dr. Hsu-Pin Wang is an associate professor of Industrial Engineering at the University of Iowa, USA, and his research interests include CAPP, concurrent engineering, artificial intelligence in manufacturing, and design of automated manufacturing systems. Professor Jian-Kang Li is head of the Department of Industrial Engineering at Nanjing Aeronautical Institute in China and Vice President of the Chinese National Group Technology Research Association.

The book is structured in ten chapters, logically brought together and its emphasis is put on the machining process planning which is the major subject. Chapters 2 through 8 are dealing with.

An assembly process planning is referred to in the last chapter.

The textual material is supported by almost 110 figures and 40 tables. Each chapter concludes with a summary and a list of related references.

The **introduction** clarifies on the basic concepts and basic requirements of process planning, as a bridge between CAD and CAM. What major decisions have to be made during process planning is also reminded.

Chapter 2 focusses on machining accuracy, reviewing its concepts and accounting for machining errors. Statistical methods for machining accuracy determination are also introduced and different ways for improving accuracy are considered.

Chapter 3 covers design, operational, locating, measuring and assembly references, which stand for points, lines and surfaces based on which the position of other points, lines or surfaces on a part or on an assembly are defined. Some principles of selecting operation and locating references are presented. The chapter ends with the presentation of some recalculation methods, which are used when the principles of coincidence of references cannot be completely complied with.

Chapter 4 makes an analysis of the process routing planning, starting with parts' drawing. This provides the information on the parts to be manufactured. The selection of machining methods and the various factors influencing this selection are also paid due attention. Stages in machining process are shown. The concepts of operation concentration and differentiation are defined as principles of process structuring and organization into operations. Following the part specifications or the technological needs of the manufacturing process, heat-treatment and auxiliary operations are finally established.

Chapter 5, entitled "Machining Operation Design", starts with machine-tools selection and the determination of machining allowances. It continues with the presentation of those methods determining both operational dimensions and tolerances of surfaces.

A description of how the best machining conditions are possible is made here. Aspects related with the determination of time elements and process plan documentation end up this chapter.

Chapter 6 presents a Group Technology philosophy. The most widely used coding systems, and also several procedures for forming part families and/or manufacturing cells, are examined.

The evolution of Computer-Aided Process Planning systems and the basic (variant and operative) approaches to their building are the subject-matter of **Chapter 7**. Some existing CAPP systems serve as exemplifications.

Chapter 8 discusses the components of a CAPP, insisting on three of them: process selection, intermediate surface determination and process sequencing. Computer algorithms and heuristics for problem-solving are considered. For process selection, the concept of matching process capabilities with surface requirements is invoked. A methodology for determining the intermediate surfaces formed by manufacturing operations is formulated, and methods fixing up

the tolerances of these surfaces are proposed. Some methods and rules of thumb are proposed for process sequencing.

Knowledge-Based Process Planning is approached in **Chapter 9**, its contents being the typology of AI applications, principles and techniques underlying Knowledge-Based Systems, knowledge representation methods and inference techniques. A neural network approach of the automatic acquisition of process planning knowledge is then proposed and the results of testing the network trained performance are revealed and analysed.

The last chapter, **Chapter 10**, of the book is devoted to assembly process planning. Under this heading, requirements for automated assembly process planning, methods for determining the relationships between components, the concept of articulation points for determining subassemblies, assembly planning algorithms are in turn discussed.

The book makes a lot of useful information available to anyone who might be interested in this subject. The reviewer found it to be appealing to specialists in both manufacturing engineering and data processing fields, with an obvious propensity to the former category.

Gabriel Neagu

For anyone interested, the book is available in Europe from ELSEVIER Science Publishers B.V., P.O.Box 1991, 1000 BZ Amsterdam, The Netherlands or in the USA / Canada from ELSEVIER Science Publishing Co. Inc. P.O.Box 882 Madison Square Station, New York, N.Y. 10159, USA