
PREFACE

The focus on productivity has been one of the main concerns of industries worldwide since the early 1990s. To increase productivity, industries have attempted to apply more computerized automation in manufacturing. Amongst the latest technologies to have significant stride over the past two decades are the *Rapid Prototyping Technologies*, otherwise also known as *Solid Freeform Fabrication*, *Desktop Manufacturing* or *Layer Manufacturing Technologies*.

The revolutionary change in factory production techniques and management requires a direct involvement of computer-controlled systems in the entire production process. Every operation in this factory, from product design, to manufacturing, to assembly and product inspection, is monitored and controlled by computers. CAD–CAM or Computer-Aided Design and Manufacturing has emerged since the 1960s to support product design. Up to the mid-1980s, it has never been easy to derive a physical prototype model, despite the existence of Computer Numerical Controlled (CNC) Machine Tools. Rapid Prototyping Technologies provide the bridge from product conceptualisation to product realization in a reasonably fast manner, without the fuss of NC programming, jigs and fixtures.

With this exciting promise, the industry and academia have internationally established research centers for Rapid Prototyping (RP), with the objectives of working in this leading edge technology, as well as of educating and training more engineers in the field of RP. An appropriate textbook is therefore required as the basis for the development of a curriculum in RP. The purpose of this book is to provide an introduction to the fundamental principles and application areas in RP. The book traces the development of RP in the arena of Advanced Manufacturing

Technologies and explains the principles underlying each of the RP techniques. Also covered are the detail descriptions of the RP processes and their specifications. In this third edition, new RP techniques are introduced and existing ones updated, bringing the total number of RP techniques described to more than 30. The book would not be complete without emphasizing the importance of RP applications in manufacturing and other industries. In addition to industrial examples provided for each of the vendors, an entire chapter is devoted to application areas. As RP has expanded its scope of applications one whole chapter that focuses on the biomedical area has been added.

One key inclusion in this book is the use of multimedia to enhance understanding of the technique. In the accompanying compact disc (CD), animation is used to demonstrate the working principles of major RP techniques such as Stereolithography, Polyjet, Laminated Object Manufacturing, Fused Deposition Modeling, Selective Laser Sintering and Three-Dimensional Printing.

In addition, the book focuses on some of the very important issues facing RP today and these include, but are not limited to:

- (1) The problems with the *de facto* STL format.
- (2) The range of applications for tooling and manufacturing, including biomedical engineering.
- (3) The benchmarking methodology in selecting an appropriate RP technique.

The material in this book has been used for more than 40 times for professional courses conducted for both academia and industry audiences since 1991. Certain materials were borne out of research conducted in the School of Mechanical and Aerospace Engineering at the Nanyang Technological University, Singapore. To be used more effectively for graduate or final year (senior year) undergraduate students in Mechanical, Aerospace, Production or Manufacturing Engineering, problems have been included in this textbook. For university professors and other tertiary-level lecturers,

the subject RP can be combined easily with other topics such as: CAD, CAM, Machine Tool Technologies and Industrial Design.

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