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George Chryssolouris

Manufacturing Systems

Theory and Practice

Second Edition

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George Chryssolouris

Manufacturing Systems: Theory and Practice



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To my father

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Series Preface

Mechanical engineering, and engineering discipline born of the needs of the industrial revolution, is once again asked to do its substantial share in the call for industrial renewal. The general call is urgent as we face profound issues of productivity and competitiveness that require engineering solutions, among others. The Mechanical Engineering Series is a series featuring graduate texts and research monographs intended to address the need for information in contemporary areas of mechanical engineering.

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Preface for the 2nd Edition

The new edition of this book reflects a number of new developments in the world of manufacturing during the past decade.

A number of my associates in our Laboratory for Manufacturing Systems and Automation, in the University of Patras, have been involved with the revision of the manuscript; among them, Dr. D. Mourtzis, Dr. N. Papakostas and Dr. V. Karabatsou were the key persons in putting the revision of this book together. K. Alexopoulos, Dr. S. Makris, Dr. D. Mavrikios, M. Pappas, K. Salonitis, P. Stavropoulos, A. Stournaras, G. Tsoukantas, and others contributed substantially to the revised text and the necessary literature research. I would like to thank all of them. Finally, I would like to thank greatly my administrative assistant in our Laboratory, Angela Sbarouni, for her typing and editing of the final manuscript.

George Chryssolouris
Patras, Greece, May 2005

Preface

This book is the derivation of my notes from a course which I have been teaching at M.I.T. on Machine Tools and Manufacturing Systems. The book is intended for students at the undergraduate or graduate level who are interested in manufacturing, industry engineers who want an overview of the issues and tools used to address problems in manufacturing systems, and managers with a technical background who want to become more familiar with manufacturing issues.

The six chapters of this book have been arranged according to the sequence used when creating and operating a manufacturing system. Chapter 1 of this book provides a general decision making framework for manufacturing. In Chapter 2 an overview of manufacturing processes, the “backbone” of any manufacturing system, is given. Chapter 3 is devoted to manufacturing equipment and machine tools, which are the “embodiment” of manufacturing processes. Chapter 4 provides an overview of process planning methods and techniques, and Chapter 5 deals with the design of manufacturing system. Chapter 6 covers manufacturing systems operation. At the end of each chapter a set of questions is provided for the purpose of reviewing the material covered in the chapter. An instructor’s manual containing solutions to these questions, along with suggested laboratory exercises, is also available.

I would like to thank the National Science Foundation, Ford Motor Co., CAM-i, and the Leaders For Manufacturing program at M.I.T. for their financial support during my work on this book. I would also like to thank Professor David Wormley, associate Dean of Engineering at M.I.T., for his encouragement and support. Professor Nam Suh, the head of the Mechanical Engineering Department at M.I.T., has provided many challenging remarks and constructive comments on the broad subject of manufacturing over the years, and I would like to thank him for his leadership and intellectual inspiration. My colleagues Professor David Hardt, the director of M.I.T.’s Lab for Manufacturing and Productivity, and Professor Timothy Gutowski, director of M.I.T.’s Industry Composites and Polymer Processing Program, have also provided me over the years with helpful remarks and discussions which have contributed significantly to my understanding of manufacturing, and for that I thank them.

A number of my graduate and undergraduate students have been involved with this manuscript; among them, Moshin Lee was instrumental in putting this book together. He, together with Nick Anastasia, Velusamy Subramaniam, Mike Domroese, Paul Sheng, Kristian Dicke, Jeff Connors, and Don Lee contributed substantially to the text, the literature research and the overall layout of the book. Their excellent contributions and helpful, friendly attitudes were great assets during the creation of this manuscript. I feel greatly indebted to all of them. Finally, I would like to thank my former administrative assistant at M.I.T., Jennifer Gilden, for her assistance in typing and editing the manuscript and for drawing many figures, and my current administrative assistant at M.I.T., Kendra Borgmann, for her help in coordinating the production of this book.

George Chryssolouris
Cambridge, September 1991

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