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R. Venkata Rao

Advanced Modeling and Optimization of Manufacturing Processes

International Research and Development

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*Dedicated to my parents (Lakshmi Narayana
and Jayamma), dearest wife (Sujatha Rao),
and beloved daughter (Jaya Lakshmi)*

Preface

Manufacturing includes various types of processes and today's manufacturing processes are caught between the growing needs for quality, high process safety, minimal manufacturing costs, and short manufacturing times. In order to meet the demands, manufacturing process setting parameters have to be chosen in the best possible way. The selection of optimum process parameters plays a significant role to ensure quality of product, to reduce the manufacturing cost and to increase productivity in computer controlled manufacturing process. For such optimization it is necessary to represent the manufacturing process in a model. However, the primary challenge for manufacturing process optimization often stems from the fact that the procedure is typically highly constrained and highly non-linear. Additionally, manufacturing process models are likely discontinuous, non-explicit, or not analytically differentiable with the design variables. Due to the enormous complexity of many manufacturing processes and the high number of influencing parameters, conventional approaches to modeling and optimization are no longer sufficient. Advanced modeling and optimization techniques are needed to be developed and used as modeling and optimization of manufacturing process is becoming increasingly important in industry in the drive towards 'agile manufacturing'.

The purpose of this book is to present a comprehensive review on latest research and development trends at international level for modeling and optimization of various manufacturing processes, particularly the machining processes which are the most frequently analyzed manufacturing processes. Using examples of various processes, the possibilities for process modeling and optimization with advanced modeling and optimization techniques are demonstrated. The book presents thorough literature of various manufacturing processes, mathematical models, traditional and non-traditional optimization techniques, real case studies, results of applications of the proposed methods, and highlights the best modeling and optimization strategies to achieve best process performance. The algorithms and computer codes for meta-heuristic optimization techniques included in the book will be very much useful to the readers.

The book is expected to be very useful to the designers and manufacturing engineers in the manufacturing sector who are responsible for the technical aspects of realizing a product as it presents new models and optimization techniques to make their tasks easier, logical, efficient and effective. The book is intended for designers, manufacturing engineers, practitioners, managers, institutes involved in design and manufacturing related projects, applied research workers, academics, and graduate students in mechanical, industrial, and manufacturing engineering.

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While every attempt has been made to ensure that no errors (printing or otherwise) enter the book, the possibility of these creeping into the book is always there. I will be grateful to the readers if these errors are pointed out. Suggestions for further improvement of the book will be thankfully acknowledged.

Surat, June 2010

R. Venkata Rao

Contents

1 Overview	1
1.1 Manufacturing Processes	1
1.2 Need for Modeling and Optimization of Manufacturing Processes	2
1.3 Some Important Modeling and Optimization Techniques	4
1.3.1 Statistical Regression Technique	4
1.3.2 Fuzzy Set Theory	6
1.3.3 Artificial Neural Networks	7
1.3.4 Gray Relational Analysis (GRA)	10
1.3.5 Taguchi Robust Design Method	13
1.3.6 Taguchi Fuzzy-Based Approach	15
1.3.7 Factorial Design Method	15
1.3.8 Response Surface Methodology	16
1.3.9 Knowledge-Based Expert Systems	18
1.3.10 Principal Component Analysis (PCA)	20
1.3.11 Mathematical Iterative Search Methods	22
1.3.12 Meta-Heuristics	29
References	51
2 Modeling and Optimization of Machining Processes	55
2.1 Introduction	55
2.2 Milling Process	57
2.2.1 Example 1: Process Parameter Optimization of Multi-pass Milling for Maximization of Production rate	70
2.2.2 Example 2: Process Parameter Optimization of Multi-pass Milling for Minimization of Cost	80
2.3 Grinding Process	84
2.3.1 Example 1: Modeling and Optimization of Rough Grinding Process	98

2.3.2	Example 2: Modeling and Optimization of Finish Grinding Process	105
2.4	Turning Process	107
2.5	Drilling Process	125
2.6	Finishing Processes	147
2.6.1	Lapping Process	147
2.6.2	Honing Process	150
2.6.3	Superfinishing Process	153
2.6.4	Ball-Burnishing Process	155
	References	160
3	Modeling and Optimization of Modern Machining Processes	177
3.1	Modern Machining Processes	177
3.2	AWJM Process	178
3.3	Ultrasonic Machining Process	192
3.4	Wire Electric Discharge Machining (WEDM) Process	203
3.4.1	Example: Parameter Optimization of WEDM Process	211
3.5	ECM Process	222
3.5.1	Modeling and Optimization of ECM Process Parameters	229
3.6	LBM Process	240
3.7	Electro Chemical Discharge Machining: A Hybrid Machining Process	252
3.8	Micro-Milling Process	257
3.9	Micro-Drilling Process	265
3.9.1	Optimization of Laser Micro-Drilling Process	272
	References	273
4	Modeling and Optimization of Nano-finishing Processes	285
4.1	Introduction	285
4.2	Abrasive Flow Machining Process	286
4.3	Magnetic Abrasive Finishing Process	298
4.4	Magnetorheological Abrasive Flow Finishing Process	307
4.5	Electrolytic In-process Dressing Process	309
	References	313
5	Modeling and Optimization of Rapid Prototyping Processes	317
5.1	Introduction	317
5.2	Modeling and Optimization	318
	References	336
6	Environmental Aspects of Manufacturing Processes	339
6.1	Environmentally Conscious Manufacturing	339
6.2	Environment-friendly Machining	342

- 6.2.1 Dry Machining 342
- 6.2.2 Cryogenic Machining 344
- 6.2.3 Solid Lubricant-Assisted Machining 351
- 6.2.4 Minimal Quantity Lubrication Machining 353
- References 357

- Appendix A Meta-Heuristic Optimization Techniques:**
 - Sample Codes 361**
 - A.1 Sample Codes for Rough Grinding Process 361
 - A.1.1 ABC Code 361
 - A.1.2 PSO Code 366
 - A.1.3 SA Code 373

- Index 379**