CONTENTS

FOREWORD		ix
PREFACE		xi
CONTENTS OF VOLUME B		xvii
INTRODUCTION		xix

PART I
The Dynamics of Digital Automation

Chapter I.	**Evaluating Data Control Opportunities**	3
	Basic Needs in Information Technology	5
	Dichotomies in Computer Usage	10
	Functional Aspects of Data Control	14
	Utilizing Past Experience	18
Chapter II.	**The Functions of a Data System**	22
	Defining Operating Conditions	23
	Outlining Control System Functions	26
	Factors in Systems Development	30
	Systems Mechanics and Memory Specifications	37
Chapter III.	**Studying the General Structure**	41
	Examining the Processing of Information	42
	Multicomputer Systems	46
	Channels and Multiplexing Requirements	51
Chapter IV.	**Principles of Systems Analysis**	57
	Critical Questions and the Systems Function	58
	Establishing the Systems Profession	63
	Systems Work and Mathematical Analysis	70

PART II
Data Collection and Teletransmission

Chapter V. **Data Collection Problems** 77
Developing Acceptable Sensory Techniques 77
Classifications in Data Collection 83
Some Data Collection Activities 88
Examining an Interface Unit 91

Chapter VI. **Conversion Methods** 96
Dynamics of Signal Processing 99
Mechanics of Analog-to-Digital Conversion 107

Chapter VII. **Data Carriers** 115
Data Transcription for Transmission Purposes 116
Data Transmission through Various Media 121
Automatic System of Telephone Exchange 130

Chapter VIII. **Structural Aspects of Teletransmission** 135
Operational Features of the "Telesystem" 136
Example of a Teletransmission Network 142
Design Approaches to Telecommunication Problems 147

PART III
Numerical, Logical, and Stochastic Processes

Chapter IX. **The Use of Numerical Systems** 157
Developments in the Art of Calculation 158
The Evolution of Numerical Systems 159
Numerical Systems for Use with Electronic Machines 162
Arithmetic Operations 165
The Process of Complementing 169

Chapter X. **Fundamentals of Boolean Algebra** 173
Examining the Boolean Logic 174
The Functions of Logical Sets 176
Minimal Forms of Boolean Functions 180
Boolean Matrices 185
Black Box Analysis through Boolean Tools 186

Chapter XI. **Classifications in Information Retrieval** 190
Automatic Information Retrieval Techniques 191
Indexing for Retrieval Purposes 194
Literary Sets and Subsets 197
Information Regeneration and Guidance Profiles 201

Chapter XII. **Stochastic Searching** 206
Dynamics of the Communications Problem 207
Evaluating Stochastic Searching 211
Machine Records and the Upkeep of a Dictionary 214
The Sophistication of the Document and the Over-All Effort 217

PART IV
Mathematics for Systems Control

Chapter XIII. **Analysis, Speculation, and Evolution** 223
An Analytical View of Data and Models 224
Technological versus Natural Systems 228
Reflections on the Process of Evolution 234
The Means and the End 237

Chapter XIV. **The Mathematical Simulator** 241
Black Boxes for Process Control Applications 242
Formulating Adequate Mathematical Models 245
Dynamics of Mathematical Experimentation 252

Chapter XV. **Evaluating Mathematical Programming** 257
Linear Approaches to Scheduling and Control 259
Scheduling Programs through Electronic Media 263
Establishing Validity before Usage 266
Integrating the Model, the Computer, and the Field Requirements 269
Mathematics for Design Automation 273

Chapter XVI. **Establishing Systems Reliability** 278
Systems Reliability Fundamentals 279
Convalescence and Its Computation 289
Defining Utility Functions 296
Matters Concerning Systems Value 298

PART V
Programming for Real-Time Duty

Chapter XVII. **Considering Programming Approaches** 307
Programming Skill for Process Control 308
Constructing a Process-Control Program 310
Examining Special Programming Features 315
Generalizing Program Characteristics 320

Chapter XVIII. **In-Memory Operations** 325
Selection in Memory 326
The Deadlock Problem 328
Access to Memory 331
Memory Dumps and Semiprograms 332
Date Retrieval and Priorities 337

Chapter XIX. **Real-Time Executive Routines** 342
Developing an Executive Program 343
Establishing Fundamental Characteristics 348
Mechanics of the Supervisory Control 352
Summarizing the Executive Action 355

Chapter XX. **Programming Aids for Process Control** 362
Designing an Assembler-Generator 363
Critical Subroutines and Function Programs 366
Assembler Commands and Macro-Operations 370
Some Reliability Considerations 374

INDEX 379