

Section IVolume 1
(Chapters 1 - 10)

Automatic Control Systems

	Automatic Control Systems	1
Ch.1.	Mechanical Automatic Control Systems.	1
	1. Time - Dependent Automatic Control Systems	1
	2. Mechanical Positional Automatic Control Systems	9
	3. Mechanical Dimensional Automatic Control Systems	11
	4. Electrical Automatic Control Systems	13
Ch.2.	Hydraulic Control Elements and Assemblies.	16
	5. Devices for obtaining the necessary Pressures in the Hydraulic System.	16
	6. Devices for Fluid Flow Distribution.	19
	7. Devices for Stepless Governing and Stabilization of Hydraulic Motor Speed.	23.
	8. Devices for Stepped Governing of Hydraulic Motor Speed	31
	9. Methods of Synchronizing the Work of Hydraulic Motors	36
	10. Hydraulic Control Panels	39
	11. Electro-Hydraulic Control	43
Ch.3.	Hydraulic and Electrohydraulic Automatic Control Systems	45
	12. The Structure of Hydraulic and Electrohydraulic Systems	45
	13. Hydraulic and Electrohydraulic Units for Performing Partial Work Cycles with Continuous Forward Feed.	46
	14. Hydraulic and Electrohydraulic Units for Executing Partial Working Cycles for Auxiliary Functions.	52
	15. Hydraulic Time-Dependent Automatic Control Systems	61
	16. Hydraulic and Electrohydraulic Positional Automatic Control Systems	64
	17. Hydraulic and Electrohydraulic Automatic Control Systems and Functions of the Pressure of the Working Medium	69
Ch.4.	Pneumatic Automatic Control Units.	72
	18. Distributing Devices	72
	19. Stabilization of the Speed of Air Motors.	73
Ch.5.	Pneumatic and Pneumohydraulic Automatic Control Systems	76
	20. Pneumatic and Pneumohydraulic Units for Performing Partial Work Cycles of Auxiliary Functions.	76
	21. Pneumohydraulic units for performing Partial Work Cycles with Continuous Forward Motion.	77

22.	Time-Dependent and Positional Pneumohydraulic Automatic Control Systems	81
-----	---	----

Section II

	Programme Control of Metal-Cutting Machines	83
--	---	----

Ch.6.	Forms of Programme Control	83
23.	Digital Programme Control	83
24.	Preparation of Drawing for Digital Programme Control	85
Ch.7.	Units of Sampled-Data Digital Programme Control Systems	86
25.	Flip-Flops (Trigger Circuits)	86
26.	Ferrite Elements	92
27.	Pulse Delaying	95
28.	Contactless Switching Devices	97
29.	Electronic Counters	103
Ch.8.	Sampled-Data Programme Control Systems	108
30.	Principal Types of Sampled-Data Digital Programme Control Systems	108
31.	Programmes for Sampled-Data Programme Control	113
32.	Reading - Heads	126
33.	Storage Devices	134
34.	Pulsed Servomechanisms	144
35.	Feedback Units	148
Ch.9.	Analogue Systems of Digital Programme Control	158
36.	Programme Media	158
37.	Digital-to-Analogue Converters	162
38.	Electrical Servo Systems	175
39.	Analogue Feedback Measuring Devices (Transducers)	190
40.	Actuating Units of Electrical Servosystems.	206
41.	The Main Types of Electric Servosystem	208
42.	Hydraulic Servosystems	218
43.	Electrohydraulic Servosystems	223
Ch.10.	Positional Digital Programme Control Systems	229
44.	Direct Positional Digital Programme Control Systems	230

45. Positional Digital Programme Control Systems
Connected to the Leadscrew. 234

Volume II
(Chapters 11 - 23)

- Ch.11. Programme Control Systems with Non-encoded Programmes 239
46. Systems with Non-encoded Punched, Magnetic, Plug-Board
and Push-Button Programme Media. 239
47. Automatic Control from Formers. 246

Section III

Automatic Control Systems for Turning Lathes 264

- Ch.12. Operating Features peculiar to Automated Turning Lathes 264
48. Process Cycles for Turning 264
49. Working and Idling Movements and Auxiliary Functions 266
- Ch.13. Position - and Time-Dependent Automatic Control Systems for
Turning Lathes 268
50. Position - Dependent Automatic Control Systems for
Turning Lathes. 268
51. Time - Dependent Automatic Control Systems for Turning
Lathes 280
- Ch.14. Digital Programme Control of Turning Lathes. 281
52. Analogue System of Digital Programme Control using
Potentiometers for a Turning Lathe 281
53. Digital Position - Dependent Automatic Control Systems 286
54. Sampled-data Automatic Control Systems for Turning
Lathes 304
- Ch.15. Programme Control of Turning Lathes with Non-Encoded
Programmes. 309
55. Control Systems Employing a Perforated Disk 309
56. Control Systems with Plug Boards 310
57. Duplicating Control Systems for Turning Lathes 312
58. Programmed Digital Control of Duplicating Turning Lathes 318

Section IV

Automatic Control Systems for Turret Lathes 321

- Ch.16. Operating Features of Automated Turret Lathes 321
59. Process Cycles of Turret-Lathe Machining 321
60. Power and Blind Traverses of the Turret and Slide 325
- Ch.17. Position - and Time-Dependent Automatic Control Systems
for Turret Lathes. 327

61.	Position-Dependent Electropneumatic Automatic Control System for the 1336 Turret Lathe Developed by the Izhevsk Machine-Building Works	327
62.	Time-Dependent Automatic Control Systems for Turret-Lathes.	336
Ch.18.	Digital Programme of Turret Lathes.	337
63.	The Warner and Swasey CA-25 Turret Lathe Automatic Control System	337
64.	Automatic Control System of the 1341P Turret Lathe Produced by the Kiev Automatic Machine Tool Works	347
65.	Automatic Control System of the Lamson Turret Lathe	357
Ch.19.	Programme Control of Turret Lathes with Non-Encoded Programmes	364
66.	Electropneumatic Control System for a Turret Lathe	364
67.	Nickols Electropneumatic Control System for a Capstan Lathe	376
68.	Electropneumatic Control System for the Pittler Turret Lathe Developed by Experimental Design Bureau No.3 (OKB-3)	386
69.	Electric Control System of the IP326 Turret Lathe	396
70.	Turret Lathe Control System with Programme Selection by Means of Rotary Switches.	401
71.	Short Review of other Automatic Control Systems for Turret Lathes.	406

Section V

	Automatic Control Systems for Milling Machines	410
Ch.20.	Particular Features of Machining on Milling Machines	410
72.	Work Cycles when Machining on Column-and-Knee Type Horizontal Milling Machines	410
73.	Work Cycles for Machining on Vertical Milling Machines	411
74.	Work Cycles for Machining on Planer-Type Milling Machines	412
75.	Procedures for Controlling Milling Machines	413
Ch.21.	Positional Automatic Control Systems for Milling Machines	414
76.	Automatic Control Systems for Executing Linear Work Cycles	414
77.	Automatic Control Systems for Executing a Linear - Indexing Work Cycle.	421

Ch.22.	Particular Features of Programming in Digital Programme Control Systems for Milling Machines	427
	78. Preparing the Planning Sheet and Determining the Cutter Path	427
	79. Programming the Machine	433
	80. Particular Features of Digital Programme Control Systems for Milling Machines	438
Ch.23.	Analogue Systems of Digital Programme Control for Milling Machines.	440
	81. The EMI Digital Programme Control System for a Vertical Milling Machine with a Rectangular Table	440
	82. Particular Features of Control of a Horizontal Milling Machine	459
	83. Particular Features of the Control of a Vertical Milling Machine with a Round Table	466
	84. Bendix Digital Programme Control System for Kearney and Trecker Milling Machines	470
	85. Bendix Digital Programme Control System for a Conoid Milling Machine	485

Volume III
(Chapters 24 - 34)

Ch.24.	Sampled Data Digital Programme Control Systems for Milling Machines	491
	86. ENIMS Type 6N13-PR Vertical Milling Machine	491
	87. Ferranti Digital Programme Control System for a Milling Machine	494
	88. Special Features of the Markiv Ferranti Digital Programme Control System for Milling Machines	505
	89. Japanese Vertical Milling Machine with Digital Programme Control	508
	90. Digimatic Digital Data-Control System for a Milling Machine	521
Ch.25.	Positional Digital Programme Control Systems for Milling Machines	527
	91. Digital Programme Control System for the Model of 41 Vertical Milling Machine made by the Kirov Works at Odessa	527
	92. Digital Programme Control System of the 6441B Vertical Milling Machine	532
Ch.26.	Duplicating Control Systems for Milling Machines	534
	93. Electrical Duplicating Systems for Milling Machines	534

	<u>Page</u>
94. Hydraulic Duplication Systems for Milling Machines	549
<u>Section VI</u>	
Automatic Control Systems for Gang Machines	556
Ch.27. Automating the Operation of Power Heads	559
95. Time-Dependent Automatic Control Systems	559
96. Position-Dependent Automatic Control Systems	563
Ch.28. Automation of Table Rotation	575
97. Electromechanical Automatic Control Systems	575
98. Hydraulic Automatic Control Systems	578
99. Electrohydraulic Automatic Control Systems	581
<u>Section VII</u>	
Automatic Control Systems for Jig-Boring, Boring and Drilling Machines.	583
Ch.29. Operating Features of Jig-Boring Machines	583
100. Purpose, Main forms of Operation and Problems of Automating Jig-Boring Machines	583
101. Movement of Table Slide into Working Position	586
102. Aligning Jig-Boring Machines to Execute a given Programme	592
103. Automatic Alignment	594
Ch.30. Analogue Digital Programme Control Systems for Jig-Boring Machines	598
104. Semi-Automatic Control System for a Jig-Boring Machine	598
105. Pratt and Whitney Automatic Control System for a Jig-Boring Machine	604
Ch.31 Position-Dependent Numerical Programme Control Systems for Jig-Boring Machines	611
106. Fosmatic Automatic Control System for Jig-Boring Machine	611
107. Automatic Control System of the 2A430P Jig-Boring Machine Produced by the Sverdlov Works	615
108. Semi-Automatic Control System for the 2P430 Jig-Boring Machine Produced by the Kirov Works at Odessa	619
Ch.32. Automatic Control Systems for Boring Machines.	624
109. Features of the Operation of Automated Boring Machines	624
110. Position-Dependent Digital Automatic Control System for a 262PR1 Horizontal Boring Machine.	626
111. Automatic Control System for the Kearns No.0 Horizontal Boring Machine	641
Ch.33 Automatic Control Systems for Drilling Machines	645

	<u>Page</u>
112. Particular Operating Features of Drilling Machines	645
113. Time-Dependent Automatic Control Systems for Drilling Machines	647
114. Positional Automatic Control System for Drilling Machines	649
115. Programme Control of the 1s2P Drilling Machine	653
Ch.34. Positioning Tables for Drilling and Boring Machines	659
116. Programme Controlled Positioning Table Developed by the Arter Grinding Machine Company	659
117. Table with Analogue Measuring System not Connected with the Leadscrew	664
118. Sperry Gyroscope Company's Coordinate Setting Table	670
References	672