

Contents

1. Preliminaries	1
1.1 What is Impulsive Control ?	1
1.2 Different Types of Impulsive Control Schemes	3
1.3 Mathematical Models of Systems with Impulsive Effects	4
1.3.1 Impulsive Events at Fixed Time	5
1.3.2 Impulsive Events at Variable Time	6
1.3.3 Discontinuous Dynamical Systems	7
1.4 Existence and Continuation of Solutions	7
1.5 Beating Phenomena	9
1.6 Solutions of Impulsive Differential Equations	11
1.7 Definitions and Basics	13
2. Linear Impulsive Control	17
2.1 Linear Impulsive Control System with Constant Parameters .	17
2.2 Impulsive Control of Time-varying Linear Systems	22
2.3 Controllability of Linear Impulsive Control Systems	26
2.3.1 Time-varying Cases	27
2.3.2 Time-invariant Cases	29
3. Comparison Methods	35
3.1 Single Comparison System	35
3.2 Impulsive Control of Chaotic Systems	48
3.2.1 Theory	48
3.2.2 Simulation Results	49
3.3 Comparison Systems with Two Measures	52
3.4 Multicomparison Systems	65
4. Impulsive Control with Fixed-time Impulses	71
4.1 Lyapunov's Second Method	71
4.2 Linear Decomposition Methods	85
4.3 Methods Based on Linearization	90
4.4 Linear Approximation Methods	94
4.5 Stability of Sets	98
4.5.1 Stability	100

4.5.2	Global Stability	106
4.6	Stability in Terms of Two Measures	112
5.	Impulsive Control with Impulses at Variable Time	119
5.1	Linear Decomposition Methods	119
5.2	Methods Based on Two Measures	125
5.3	Stability of Prescribed Control Strategies	138
6.	Practical Stability of Impulsive Control	149
6.1	Practical Stability Based on Single Comparison System	149
6.2	Practical Stability in Terms of Two Measures	159
6.2.1	Definitions and Notations	159
6.2.2	Comparison System	160
6.2.3	Controllability	166
6.2.4	Examples	168
6.3	Practical Stability of Linear Impulsive Control Systems	169
6.4	Practical Stability in Terms of Multicomparison Systems	170
6.4.1	An Example	181
6.5	Controllability in Terms of Multicomparison Systems	184
6.5.1	Examples	186
6.6	Impulsive Control of Nonautonomous Chaotic Systems	187
6.6.1	Theory	187
6.7	Examples	190
6.7.1	Example 1	190
6.7.2	Example 2	193
6.7.3	Example 3: Duffing's Oscillator	195
7.	Other Impulsive Control Strategies	199
7.1	Partial Stability of Impulsive Control	199
7.1.1	Control Impulses at Variable Time	199
7.1.2	Control Impulses at Fixed Time	205
7.2	Impulsive Control of Integro-differential Systems	208
7.2.1	Comparison Results	209
7.2.2	Stability in Terms of Two Measures	213
7.2.3	Practical Stability	217
8.	Impulsive Computational Verb Control	219
8.1	Design of Verb Controller with Fuzzy Errors	220
8.2	Design of Verb Controller with Verb Singletons	222
8.3	Examples of Verb Control Systems	224
8.4	Linear Verb Control Systems	228
8.4.1	Using Different Controlling Verbs	229
8.4.2	Using Single Controlling Verb	231
8.5	Impulsive Verb Control Based on Basin of Stability	232

9. Impulsive Control of Periodic Motions	237
9.1 Linear Periodic Impulsive Control	237
9.1.1 Autonomous Cases	237
9.1.2 Nonautonomous Cases	246
9.2 Parameter Perturbation Methods and Robustness	256
9.2.1 Linear Control Systems	256
9.2.2 Nonlinear Control Systems	264
9.2.3 Control Impulses at Variable Time	267
9.3 Applications	277
9.3.1 Control Rössler System to Periodic Motions	277
9.3.2 Control of Stepping Motor	282
10. Impulsive Control of Almost Periodic Motions	289
10.1 Almost Periodic Sequences and Functions	289
10.2 Bohr Almost Periodic Linear Systems	290
10.3 T -Periodic Linear System with Almost Periodic Control	297
10.3.1 First-Order Case	297
10.3.2 Multi-Dimensional Cases	299
11. Applications to Nanoelectronics	307
11.1 Models of Impulsive Electronic Devices	307
11.2 Driven SETJ Electronic Circuit	311
11.2.1 Circuit Model and its Dimensionless Form	312
11.2.2 T -periodic Solutions	313
11.3 Return Maps of Driven SETJ Circuits	315
11.4 T -Periodic Solutions of a Second-order SETJ Circuit	319
11.5 T -Periodic Solutions of a Nanoelectronic Circuit Consisting of IVCCS	323
11.6 T -Periodic Solutions of First-order Nanoelectronic Circuits	327
11.6.1 Circuit Consisting of Linear IVCCS	327
11.6.2 Circuit Consisting of Nonlinear IVCCS	329
11.7 Nanoelectronic Circuit Consisting of Nonlinear IVCCS	330
References	335
Index	339