

Contents

Chapter 1. Stability of Hybrid Systems on Time Scale.....	1
Introduction	1
1.1. Elements of Time-Scale Calculus	2
1.2. Perturbed Motion Equations of Hybrid Systems	3
1.3. Formulation of Stability Problem	5
1.4. Methods of Stability Analysis of Systems on a Time Scale.....	6
1.4.1. Dynamic Integral Inequalities	7
1.4.2. Generalized Lyapunov's Second Method.....	11
1.4.3. General Problem of Polydynamics	14
1.4.4. Construction of a Lyapunov Function	15
1.4.5. Comparison Method on a Time Scale.....	17
1.4.6. Combined Approach.....	20
1.5. Model of a Neural System on a Time Scale.....	22
1.6. Concluding Remarks	26
References	27
Chapter 2 Stability of Hybrid Systems with Aftereffect.....	29
Introduction	29
2.1. Impulsive Hybrid Aftereffect Systems	30
2.2. Statement of the Aftereffect Problem	30

2.3. A Matrix-Valued Function on the Product of Spaces	32
2.4. Sufficient Stability Conditions	34
2.5. Stabilization of an Impulsive Hybrid System.....	44
2.6. Conditions of Stability with Respect to Two Measures	48
2.7. Existence Conditions for Periodic Motions	55
2.8 Concluding Remarks	59
References	60

Chapter 3 Stability of Hybrid Systems in a Metric Space 63

Introduction	63
3.1. Preliminaries	64
3.2. Formulation of Stability Problem	65
3.3. Generalized Lyapunov's Second Method.....	67
3.4. μ -Stability of the Motion of Hybrid Systems	71
3.5. Stability of a Two-Component Hybrid System	82
3.6 Concluding Remarks	85
References	86

Chapter 4. Hybrid Systems with Impacts.....89

Introduction	89
4.1. System with Impacts.....	90
4.2. Lyapunov Stability of the Periodic Motion with Impacts	93
4.3. Ball Bouncing in the Gravitational Field	95
4.3.1. Subject of the Study	95
4.4. The Poincaré Map	96
4.5. Periodic Points and the Stability	98
4.5.1. Stability of the k-Cycle Motion.....	99
4.5.2. Example of the Stability of the Two-Cycle Motion.....	100
References	103

Chapter 5. Material Point Over Moving Limiters.....105

Introduction	105
5.1 Sawtooth Wave Limiter	106
5.1.1. Plastic Impact.....	107

5.1.2 Elastic Impacts	109
5.1.2.1. Drift Factor	110
5.1.2.2. Periodic Motion, Fixed Points	118
5.1.2.3. Case of One Impact in n Periods	121
5.1.2.4. Case of m Impacts in One Period	123
5.1.2.5. Grazing	126
5.1.3. Perfectly Elastic Impacts	127
5.2. Triangular Wave Limiter	129
5.2.1. Plastic Impacts	129
5.2.2 Elastic Impacts	130
5.2.2.1 Grazing	141
5.2.2.2. One Impact in n Periods	142
5.2.2.3. Case of m Impacts in One Period	144
5.2.2.4. Two Impacts in One Period	145
5.2.2.5. Three Impacts in One Period	146
5.2.3. Periodic Motion, Fixed Points	147
5.2.4. Perfectly Elastic Impacts	148
5.3. Sinusoidal Motion Limiter	150
5.3.1. Plastic Impacts	151
5.3.2 Elastic Impacts	154
5.3.2.1. Modes of Elastic Collisions	157
5.3.2.2. Manifold of the Rest Points	159
5.3.2.3. Motion Stability	161
5.3.3.1. Fixed Points and their Stability	162
References	167

Chapter 6. Difference Equations and Inequalities 171

Introduction	171
6.1. Stability of the Recurrent Equation	172
6.2. Stability Domain and the Domain of Stable Solutions	174
6.2.1. Stability Domain of Solutions	174
6.2.2. Domain of a Set of Stable Solutions	177
6.3. Implicit Difference Equations	182
6.4. Some Global Estimations of Solutions	183

6.5. Stability of Higher-Order Difference Equations.....	185
6.6. Manifolds of Stability of Motion With Impacts	187
References	189
Index	191