

Contents

Preface	VII
1 Main concepts and definitions	1
1.1 Dynamic systems	1
1.2 Stable and rough systems	5
1.3 Influence of external action properties on indexes of system successful functioning.....	7
1.4 Robust systems	9
1.5 Low-sensitivity systems.....	15
2 Formalization of dynamic systems investigation problems	22
2.1 Mathematical description of dynamic systems	22
2.2 Basic structures of control systems	27
2.3 Classification of investigation methods for dynamic systems	32
2.4 Control precision factors and classes of input actions	37
3 A priori information obtainment and analysis on input actions and its derivatives	44
3.1 Interaction of action and its derivatives characteristics	44
3.2 Experimental determination of spectral and correlation characteristics of actions	48
3.3 Experimental determination of numerical characteristics for action derivatives	56
3.4 Determination of input action characteristics based on theoretical analysis	60
4 Robust Wiener filtering	67
4.1. Optimal filtering at full, a priori information	67
4.2 Minimax robust filtering with the band model of spectral indeterminacy	75
4.3 Strict determination of the most unfavorable spectral densities of actions with band models of spectral indeterminacy	79
4.4 Minimax robust filtering with models of spectral density with ε -pollution	94
5 Analysis of control error dispersion by numerical characteristics of actions	97
5.1. Introduction.....	97

5.2 Use of canonical presentations for sequence of spectral density moments	100
5.3 Approximative method of estimation	105
5.4 Upper estimate of dynamic error dispersion	111
5.5 The lower estimate for dispersion of dynamic error	118
5.6 Design equations at known dispersions of action and two of its younger derivatives.....	121
5.7 Estimations for dispersion of error from interference.....	125
5.8 Use of equivalent harmonic actions.....	129
6 Analysis of maximum control error	136
6.1 Preliminary notes.....	136
6.2 Calculation of maximum error with the restriction of one action derivative	139
6.3 Calculation of maximum error with the restriction of several action derivatives	146
6.4 Approximate upper estimate of maximum error.....	152
6.5 Frequency method for maximum error estimation	155
6.6 Precision of the frequency domain method	162
6.7 Design example	167
7 Synthesis of control systems with preset ensured operation accuracy	173
7.1 Principles of construction: the forbidden areas for Bode diagrams in open loop systems	173
7.2 Restriction of dynamic error dispersion.....	178
7.3 Restriction of maximum dynamic error	188
7.4 Restriction of error from interference and total error measures.....	194
8 Optimization of control systems by criterion of highest ensured accuracy	202
8.1 Analytical and numeric methods	202
8.2 Graphic-analytical method.....	207
8.3 Estimation of loss in potential accuracy when lacking priory information	210
9 Digital robust systems	216
9.1 Determination of characteristics for discrete in time domain values of actions	216
9.2 Synthesis of closed loop digital robust systems.....	221
9.3 Synthesis of digital robust functional elements of dynamic systems	227
References	239