

TABLE OF CONTENTS

PREFACE	ix
Part 1. The Quasiregular Cauchy Problem	1
CHAPTER 1. SOLUTION EXPANSIONS OF THE QUASIREGULAR CAUCHY PROBLEM	3
§1 Solution of the Quasiregular Cauchy Problem	3
§2 Statement of Theorems about the Quasiregular Cauchy Problem	7
§3 Proof of Theorems 2.1–2.4	14
§4 Proof of Theorems 2.5–2.8	23
§5 Proof of Theorem 2.9	36
§6 Proof of Theorem 2.10	40
§7 Proof of Theorem 2.11	42
§8 Examples of the Quasiregular Cauchy Problem	43
§9 The Regularly Perturbed Cauchy Problem	49
§10 Examples of the Regularly Perturbed Cauchy Problem . . .	56
§11 Estimates of the Convergence Radius	65
§12 Estimates of the Convergence Time Interval	72
§13 Estimates of the Cauchy Matrix Norm, I	76
§14 Conclusions of Chapter 1	81
CHAPTER 2. THE VAN DER POL PROBLEM	83
§15 Reduction to the Quasiregular Cauchy Problem	83
§16 Solution Construction	88
§17 Application of Theorems on the Quasiregular Cauchy Problem	93
§18 Numerical Estimates of the Asymptotic Solution Accuracy .	107
§19 More on the van der Pol Problem	119
§20 Conclusions of Chapter 2	127
§21 Conclusions of Part 1	127

Part 2. The Tikhonov Problem	129
CHAPTER 3. THE BOUNDARY FUNCTIONS METHOD	131
§22 Definition of the Tikhonov Problem	131
§23 Construction of the Asymptotic Solution by the Boundary Functions Method	132
§24 Algorithm for Computing the Asymptotics Coefficients . .	136
§25 Algorithm for Computing the Asymptotics Coefficients for $m = 2$	141
§26 Conditions Imposed on the Singular Equations	144
§27 Conditions Imposed on the Singular Equations for $m = 2$.	147
§28 Statements of Theorems about the Boundary Functions Method	148
§29 Proof of Theorem 28.5	154
§30 Limiting Theorems	159
§31 Examples of Using the Boundary Functions Method	164
§32 Conclusions of Chapter 3	179
CHAPTER 4. PROOF OF THEOREMS 28.1–28.4	181
§33 The Functions $y_j^{(0)}$	181
§34 The Functions $y_j^{(k)}$	186
§35 The Functions $y_1^{(k)}$	194
§36 Introduction of the Auxiliary Variable	198
§37 The Matrices V_i	199
§38 The Functions G_i	203
§39 The Functions a, b, c	215
§40 Application of Theorem 28.5	229
§41 Conclusions of Chapter 4	230
CHAPTER 5. THE METHOD OF TWO PARAMETERS	231
§42 Construction of the Asymptotic Solution by the Method of Two Parameters	231
§43 Statement of Theorems about the Method of Two Parameters	232
§44 Proof of Theorems 43.1–43.4	236
§45 Proof of Theorems 43.5–43.8	249
§46 Proof of Theorem 43.9	262
§47 Examples of Using the Method of Two Parameters	268
§48 Conclusions of Chapter 5	271

CHAPTER 6. THE MOTION OF A GYROSCOPE MOUNTED IN GIMBALS	272
§49 Reduction to the Singularly Perturbed Problem	272
§50 Application of the Method of Boundary Functions	276
§51 Modification of the Method of Boundary Functions	286
§52 Application of the Method of Two Parameters	295
§53 Modification of the Method of Two Parameters	297
§54 Application of the Second Method of Lyapunov	298
§55 Connection of the Method of Boundary Functions and the Method of Two Parameters with the Second Method of Lyapunov	300
§56 The Motion of a Gyroscope Mounted in Gimbals and the Regularly Perturbed Cauchy Problem	304
§57 Conclusions of Chapter 6	305
CHAPTER 7. SUPPLEMENT	306
§58 The Tikhonov Problem and the Regularly Perturbed Cauchy Problem	306
§59 Proof of Theorems 58.1, 58.2	311
§60 Estimates of the Cauchy Matrix Norm, II	322
§61 Conclusions of Chapter 7	322
§62 Conclusions of Part 2	323
Part 3. The Double-Singular Cauchy Problem	325
CHAPTER 8. THE BOUNDARY FUNCTIONS METHOD	327
§63 Definition of the Double-Singular Cauchy Problem	327
§64 Construction of the Asymptotic Solution by the Boundary Functions Method	328
§65 Algorithm for Computing the Coefficients of Asymptotics	331
§66 Conditions Imposed on the Double-Singular Cauchy Problem	334
§67 Statement of Theorems about the Boundary Functions Method	336
§68 Proof of Theorems 67.1-67.4	338
§69 Limiting Theorems	345
§70 Example of Using the Boundary Functions Method	346
§71 Conclusions of Chapter 8	349

CHAPTER 9. THE METHOD OF TWO PARAMETERS	350
§72 Construction of the Asymptotic Solution by the Method of Two Parameters	350
§73 Theorems on the Method of Two Parameters	351
§74 Example of Using the Method of Two Parameters	356
§75 Conclusions of Chapter 9	357
§76 Conclusions of Part 3	358
 BIBLIOGRAPHY	 359
 INDEX	 363