

Contents

List of Figures	vii
List of Algorithms	ix
Preface	xi
1 Introduction	1
2 Preliminaries	7
2.1 Basics	7
2.2 Weierstrass Canonical Form	8
2.3 Hamiltonian and Symplectic Matrices	9
3 General Theory of Doubling Algorithms	11
3.1 Nonlinear Matrix Equations Associated with Eigenvalue Problems	11
3.2 Doubling Transformation Theorem	13
3.3 Two Standard Forms	15
3.4 Two Structure-Preserving Doubling Algorithms	19
3.5 Dual Equations	26
3.6 The Möbius Transformation	29
3.7 Convergence Analysis: Regular Case	34
3.8 Convergence Analysis: Critical Case	38
3.9 Stopping Criteria	51
3.10 Incorporate Initial Guesses	52
4 Discrete-Time Algebraic Riccati Equation	55
4.1 Background	55
4.2 DARE	56
4.3 Doubling Algorithm	58
4.4 Convergence Analysis	59
4.5 Examples	61
5 Continuous-Time Algebraic Riccati Equation	65
5.1 Background	65
5.2 CARE	66
5.3 The Doubling Algorithm	67
5.4 Convergence Analysis	70
5.5 Choosing Optimal γ	72
5.6 Examples	74

6	<i>M</i>-matrix Algebraic Riccati Equation	77
6.1	Background	77
6.2	MARE	80
6.3	The Doubling Algorithm	82
6.4	Convergence Analysis	84
6.5	Accurate Implementation	86
6.6	Examples	91
7	Other Algebraic Riccati Equations	95
7.1	H^* -matrix Algebraic Riccati Equation	95
7.2	Bethe–Salpeter Algebraic Riccati Equation	99
8	Nonlinear Matrix Equations $X + BX^{-1}A = Q$	105
8.1	Background	105
8.2	Nonlinear Matrix Equations	109
8.3	Existence of Stabilizing Solution	111
8.4	Doubling Algorithm	121
8.5	Convergence Analysis: Regular Case	122
8.6	Convergence Analysis: Critical Case	126
8.7	Examples	128
	Bibliography	135
	Index	143