Contents

Preface				
1.	Introduction — the Tools of the Trade			
	1.1	Motivation	1	
	1.2	Sets Involving a Single Subscript — Vectors	3	
	1.3	Sets Involving Two Subscripts — Matrices	6	
	1.4	Further Consequences and Definitions	12	
	1.5	Partitioning	14	
	1.6	Complex Matrices and Vectors	17	
	Exe	rcises	20	
2.	Som	e Elementary Consequences of Linear Independence	25	
	2.1	Linear Independence	25	
	2.2	The Unit Matrix	28	
		A Fundamental Result	29	
		The Inverse Matrix	30	
		Particular Nonsingular Matrices	32	
		The Solution of Linear Simultaneous Equations	35	
	2.7	· · · · · · · · · · · · · · · · · ·	37	
	Exer	cises	37	
3.	Matrix and Vector Norms		41	
	3.1	The Concept of a Norm	41	
	3.2	Matrix Norms	43	
	3.3	Explicit Expressions for Matrix Norms	45	
	3.4		47	
	3.5	Some Further Results	48	
	3.6	0.00	49	
	Exercises		51	

viii CONTENTS

4.	The	Practical Solution of Linear Equations	54
	4.1	Introduction	54
	4.2	LU, or Triangular, Decomposition	56
	4.3	Choleski Decomposition	58
	4.4	Gaussian Elimination	60
	4.5	Numerical Considerations	63
	4.6		66
	4.7	Iterative Improvement	69
	Exe	cises	70
5.	Eigenvalues and Eigenvectors		
	5.1	Introduction	74
	5.2	Elementary Properties of Eigenvalues	77
	5.3	Elementary Properties of Eigenvectors	84
	5.4	Eigenvalues and Norms	89
	5.5	Convergent Matrices	92
	Exe	cises	95
6.	The Practical Evaluation of Eigenvalues and Eigenvectors		
	6.1	Basic Considerations	99
	6.2	The Power Method	101
	6.3	Inverse Iteration	102
	6.4	Jacobi's Method for Real Symmetric Matrices	103
	6.5	Elementary Orthogonal Matrices	106
	6.6	Reduction to Triangular or Hessenberg Form	109
	6.7	Algorithms of QR Type	111
	6.8	Numerical Considerations	116
	Exe	cises	121
7.	Furt	her Properties of Linear Equations	124
	Part 1: General Considerations		
	7.1	The Concept of Rank	124
	7.2	The General Set of Linear Equations	128
	Part 2: Equations Associated with the Linear Programming Problem		130
	7.3	Basic Solutions	130
	7.4	Feasible Solutions	135
	Exe	rcises	137
8.	Scalar Functions of a Vector		
	8.1	The General Scalar Function	139
	8.2	Linear and Quadratic Functions	142

		CONTENTS	ix
	8.3	Further Properties of Quadratic Functions	148
	8.4	Linear Least-squares Problems	154
	Exer	158	
9.	Linear Programming		160
	9.1	The General Linear Programming Problem	160
	9.2	The Simplex Method	164
	9.3	Calculation of the Initial Feasible Solution	170
	9.4	The Resolution of Degeneracy	175
	9.5	Computational Variations	179
	Exercises		182
10.	Duality		186
	10.1	The Dual Problem	186
	10.2	2 Complementary Solutions	190
		The Dual Simplex Method	196
	Exercises		200
App	203		
References			207

Index

209