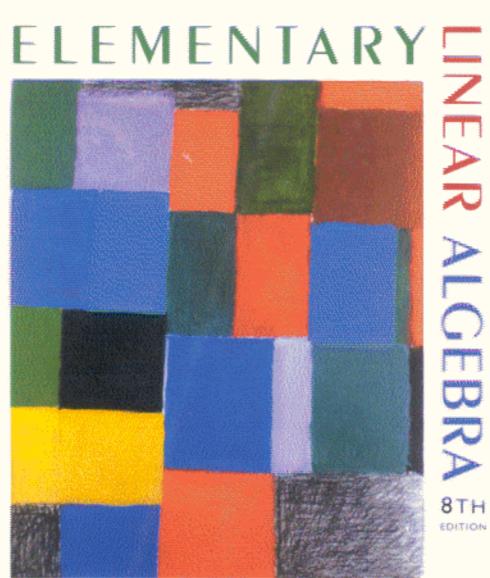
International Edition



EDITION

BERNARD KOLMAN DAVID R. HILL

CONTENTS

	Preface xi				
1	Li	near Equations and Matrices 1			
	1.1	Systems of Linear Equations 1			
	1.2	Matrices 10			
	1.3	Matrix Multiplication 19			
	1.4	Algebraic Properties of Matrix Operations 31			
	1.5	Special Types of Matrices and Partitioned Matrices 39			
	1.6	Matrix Transformations 50			
	1.7	Computer Graphics (Optional) 58			
	1.8	Correlation Coefficient (Optional) 66			
		Supplementary Exercises 73			
2	S	olving Linear Systems 77			
	2.1	Echelon Form of a Matrix 77			
	2.2	Elementary Matrices; Finding A^{-1} 101			
	2.3	· -			
	2.4				
		Supplementary Exercises 121			
3	R	teal Vector Spaces 124			
	3.1	Vectors in the Plane and in 3-Space 124			
	3.2	Vector Spaces 135			
	3.3	Subspaces 142			
	3.4	Span and Linear Independence 154			
	3.5	Basis and Dimension 164			
	3.6	Homogeneous Systems 178			
	3.7	Coordinates and Isomorphisms 186			
	3.8	Rank of a Matrix 201			
		Supplementary Exercises 214			

4 Inner Product Spaces

4.1 Length and Direction in R² and R³ 219
4.2 Cross Product in R³ (Optional) 228

	4.3	Inner Product Spaces 235	
	4.4	Gram-Schmidt Process 248	
	4.5	Orthogonal Complements 260	
	4.6	Least Squares (Optional) 276	
		Supplementary Exercises 283	
5	Li	near Transformations and Matrices	288
	5.1	Definition and Examples 288	
	5.2	Kernel and Range of a Linear Transformation 299	
	5.3	Matrix of a Linear Transformation 314	
	5.4	Vector Space of Matrices and Vector Space of Linear Transformations (Optional)	324
	5.5	Similarity 331	
	5.6	Introduction to Homogeneous Coordinates (Optional)	338
		Supplementary Exercises 354	
6	D	eterminants 358	
	6.1	Definition 358	
	6.2	Properties of Determinants 363	
	6.3	Cofactor Expansion 373	
	6.4	Inverse of a Matrix 380	
	6.5	Other Applications of Determinants 384	
	6.6	Determinants from a Computational Point of View Supplementary Exercises 391	390
7	E	igenvalues and Eigenvectors 393	
	7.1	Eigenvalues and Eigenvectors 393	
	7.2	Diagonalization and Similar Matrices 410	
	7.3	Stable Age Distribution in a Population; Markov Processes (Optional) 420	
	7.4	Diagonalization of Symmetric Matrices .427	
	7.5	Spectral Decomposition and Singular Value Decomposition (Optional) 439	
	7.6	Real Quadratic Forms 450	
	7.7	Conic Sections 460	
	7.8	Quadric Surfaces 468	•
	7.9	Dominant Eigenvalue and Principal Component Analysis (Optional) 477	
		Supplementary Exercises 491	

8 D	ifferential Equations (Optional) 494
8.1	Differential Equations 494
8.2	· ·
	Supplementary Exercises 513
9 N	NATLAB for Linear Algebra 516
9.1	Input and Output in MATLAB 517
9.2	Matrix Operations in MATLAB 522
9.3	Matrix Powers and Some Special Matrices 525
9.4	Elementary Row Operations in MATLAB 528
9.5	Matrix Inverses in MATLAB 538
9.6	Vectors in MATLAB 539 Applications of Linear Combinations in MATLAB 541
9.7 9.8	ippiidations of Zanta Tomores and a second
9.9	'
A .1	dix A: Preliminaries 569 Sets 569 Functions 569
	dix B: Complex Numbers 573 Complex Numbers 573
B.2	Complex Numbers in Linear Algebra 581
pen	dix C: Introduction to Proofs 590
C.1	Logic 590
	Techniques of Proof 595
ıswe	rs to Odd-Numbered Exercises 599
dex	I-1
age li nd Co	ndex to Lemmas, Theorems, prollaries 1-9

Photo Credits P-1