

Contents

List of Figures	viii
List of Tables	xi
Preface	xiii
Acknowledgements	xvi
1 Preliminary Background	1
2 Matrices and Linear Transformations	9
3 Operational Fundamentals of Linear Algebra	14
4 Systems of Linear Equations	21
5 Gauss Elimination Family of Methods	29
6 Special Systems and Special Methods	36
7 Numerical Aspects in Linear Systems	43
8 Eigenvalues and Eigenvectors	52
9 Diagonalization and Similarity Transformations	59
10 Jacobi and Givens Rotation Methods	66
11 Householder Transformation and Tridiagonal Matrices	73
12 QR Decomposition Method	80
13 Eigenvalue Problem of General Matrices	90
14 Singular Value Decomposition	97
15 Vector Spaces: Fundamental Concepts*	107

16 Topics in Multivariate Calculus	117
17 Vector Analysis: Curves and Surfaces	128
18 Scalar and Vector Fields	139
19 Polynomial Equations	152
20 Solution of Nonlinear Equations and Systems	162
21 Optimization: Introduction	169
22 Multivariate Optimization	179
23 Methods of Nonlinear Optimization*	189
24 Constrained Optimization	199
25 Linear and Quadratic Programming Problems*	209
26 Interpolation and Approximation	219
27 Basic Methods of Numerical Integration	229
28 Advanced Topics in Numerical Integration*	238
29 Numerical Solution of Ordinary Differential Equations	245
30 ODE Solutions: Advanced Issues	254
31 Existence and Uniqueness Theory	264
32 First Order Ordinary Differential Equations	271
33 Second Order Linear Homogeneous ODE's	282
34 Second Order Linear Non-Homogeneous ODE's	291
35 Higher Order Linear ODE's	298
36 Laplace Transforms	305
37 ODE Systems	314
38 Stability of Dynamic Systems	319
39 Series Solutions and Special Functions	329
40 Sturm-Liouville Theory	340
41 Fourier Series and Integrals	351

CONTENTS	vii
42 Fourier Transforms	359
43 Minimax Approximation*	366
44 Partial Differential Equations	373
45 Analytic Functions	389
46 Integrals in the Complex Plane	398
47 Singularities of Complex Functions	406
48 Variational Calculus*	413
Epilogue	428
Bibliography	429
Appendix	433
A Answers, Solution Outlines and Comments to Exercises	435
B Basic Formulae and Results	491
Index	497