TABLE OF CONTENTS

| 1 | App | lied Linear Algebra | |
|---|-----|---|-----------------------|
| | 1.1 | Four Special Matrices | 1 |
| | 1.2 | Differences, Derivatives, Boundary Conditions | 13 |
| | 1.3 | Elimination Leads to $K = LDL^{T}$ | medica Granday in 27 |
| | 1.4 | Inverses and Delta Functions | 37 |
| | 1.5 | Eigenvalues and Eigenvectors | 48 |
| | 1.6 | Positive Definite Matrices | 69 |
| | 1.7 | Numerical Linear Algebra: LU, QR, SVD | 82 |
| | 1.8 | Best Busis II our live | meteoretische 96 |
| 2 | A F | | 102 |
| | 2.1 | Equilibrium and the Stiffness Matrix | 102 |
| | 2.2 | Oscillation by Newton's Law | evaluate the core 115 |
| | 2.3 | Least Squares for Rectangular Matrices | 133 |
| | 2.4 | | 148 |
| | 2.5 | Networks and Transfer Functions | 163 |
| | 2.6 | Nonlinear Problems | 179 |
| | 2.7 | Structures in Equilibrium | 194 |
| | 2.8 | Covariances and Recursive Least Squares | 210 |
| * | 2.9 | Graph Cuts and Gene Clustering | 227 |
| 3 | Bou | ndary Value Problems | 239 |
| | 3.1 | | 239 |
| | 3.2 | | 255 |
| | 3.3 | Gradient and Divergence | 266 |
| | 3.4 | Laplace's Equation | 281 |
| | 3.5 | Finite Differences and Fast Poisson Solvers | 295 |
| | 3.6 | The Finite Element Method | 305 |
| | 3.7 | Elasticity and Solid Mechanics | 322 |
| 4 | Fou | rier Series and Integrals | 329 |
| | 4.1 | Fourier Series for Periodic Functions | 329 |
| | 4.2 | Chebyshev, Legendre, and Bessel | 347 |
| | 4.3 | Discrete Fourier Transform and the FFT | 359 |
| | 4.4 | Convolution and Signal Processing | 369 |
| | 4.5 | Fourier Integrals | 381 |
| | 4.6 | Deconvolution and Integral Equations | 395 |
| | 4.7 | Wavelets and Signal Processing | 403 |

| 5 | Ana | alytic Functions | 418 | |
|------|-------------------------------------|--|----------------|--|
| | 5.1 | Taylor Series and Complex Integration | 418 | |
| | 5.2 | Famous Functions and Great Theorems | 435 | |
| | 5.3 | The Laplace Transform and z-Transform | 443 | |
| | 5.4 | Spectral Methods of Exponential Accuracy | 150 | |
| 6 | Initial Value Problems | | | |
| | 6.1 | Introduction | 474 | |
| | 6.2 | Finite Difference Methods | | |
| | 6.3 | Accuracy and Stability for $u_t = c u_x$ | 490 | |
| | 6.4 | Wave Equations and Staggered Leapfrog | | |
| | 6.5 | Diffusion, Convection, and Finance | | |
| | 6.6 | Nonlinear Flow and Conservation Laws | 535 | |
| | 6.7 | Fluid Flow and Navier-Stokes | | |
| | 6.8 | Level Sets and Fast Marching | 566 | |
| 7 | Solving Large Systems | | | |
| | 7.1 | Elimination with Reordering | 570 570 | |
| | 7.2 | Iterative Methods | | |
| | 7.3 | Multigrid Methods | 591 | |
| | 7.4 | Krylov Subspaces and Conjugate Gradients | 606 | |
| 8 | Optimization and Minimum Principles | | | |
| | 8.1 | Two Fundamental Examples | 618 618 | |
| | 8.2 | Regularized Least Squares | | |
| | 8.3 | Calculus of Variations | | |
| | 8.4 | Errors in Projections and Eigenvalues | | |
| | 8.5 | The Saddle Point Stokes Problem | 672 | |
| | 8.6 | Linear Programming and Duality | 682 | |
| | 8.7 | | 699 | |
| Line | Linear Algebra in a Nutshell | | | |
| Con | nput | ational Science and Engineering | 712 | |
| | 2,00 | ries for Periodic Functions | | |
| Bibl | iogr | aphy The sili box emotions I estate | 716 | |
| Inde | ex | | | |
| | | | | |