## Contents

Introduction

CHAPTER 1	
General Properties	6
1.1. The Simplest Example	6
1.2. Expansion Theorems	16
1.3. Acceleration of Convergence	22
1.4. Correction by Higher-Order Differences	30
1.5. Various Extrapolation Methods	36
1.6. The Effects of Computational Errors	41
CHAPTER 2	
First-Order Ordinary Differential Equations	44
2.1. The Crank-Nicholson Scheme	45
2.2. Explicit Difference Schemes	61
2.3. The Splitting-Up Method for Systems of Equations	78
2.4. Equations with Singularities	86
CHAPTER 3	
The One-Dimensional Stationary Diffusion Equation	91
3.1. The Dirichlet Problem	91
3.2. Boundary-Value Problems of the Third Kind	97
3.3. Equations with Discontinuous Coefficients	103
3.4. The Sturm-Liouville Problem	114
3.5. Improving the Accuracy of the Finite Elements Method	133
3.6. The Quasilinear Problem	146

X Contents

CHAPTER 4	
Elliptic Equations	159
4.1. The Statement of the Problem	159
4.2. Difference Methods for the Dirichlet Problem on a Domain with a	
Smooth Boundary	162
4.3. The Dirichlet Problem in a Rectangle	184
4.4. A Quasilinear Equation in a Triangular Region	190
4.5. On the Diffraction Problem	204
4.6. On the Separation of Singularities	214
CHAPTER 5	
Nonstationary Problems	229
5.1. The Simplest Type of Parabolic Equation	229
5.2. Increasing the Accuracy of the Splitting-Up Method	237
5.3. The Two-Dimensional Heat Equation	246
5.4. The Equation of Motion	270
CHAPTER 6	250
Extrapolation for Algebraic Problems and Integral Equations	278
6.1. Regularization of a Singular System of Linear Algebraic Equations	279
6.2. Regularization of a System with a Selfadjoint Matrix	285
6.3. Extrapolation of Solutions Containing Boundary-Layer Functions	291 300
6.4. The Fredholm Equation of the Second Kind	
6.5. The Volterra Equation of the Second Kind	302
6.6. The Volterra Equation of the First Kind	305
CHAPTER 7	310
Appendix	310
7.1. Expansion of Difference Relations in the Mesh-Size	313
7.2. On the Solution of Some Special Systems of Equations	318
7.3. Some Results on the Lagrange Interpolation Polynomials	310
List of Notation	323
Bibliography	32:
Index	33