Contents

Preface vii

Chapter 1 INTRODUCTION 1 Chapter 2 **BASIC CONCEPTS OF THE FINITE-DIFFERENCE** METHOD 7 **Preliminary Remarks** 2.1 7 2.2 Approximation 12 Stability; Convergence Theorem 2.3 16 2.4 Stability Analysis of Finite-Difference Computations by the Fourier Transformation 22 2.5 Stability Analysis of Finite-Difference Computations by the Maximum Principle 30 2.6 Construction of Calculation Formulas 34

2.7 Solution of Difference Equations 48

Chapter 3	HEAT-CONDUCTION PROBLEMS	57
3.1	Simple Heat-Conduction Problems 57	
3.2	Finite-Difference Algorithms for One-Dimensional	
	Heat-Conduction Problems with Constant Thermal	
	Diffusivities 60	
3.3	Characteristics of Numerical Solutions of	
	Heat-Conduction Problems in Cylindrical	
	and Spherical Geometries 67	
3.4	Approximations of Boundary Conditions 69	
3.5	Finite-Difference Procedures for Heat-Conduction	
	Equations with Variable Coefficients 76	
3.6	Fractional-Step Method 82	
3.7	Two-Dimensional Heat-Conduction Problems 85	
3.8	Difference Methods Applicable to Three-Dimensional	
	Heat-Conduction Problems 91	
3.9	Nonlinear Heat-Conduction Problems 74	
Chapter 4	CONVECTIVE HEAT TRANSFER	99
4.1	Convection Equations; Boundary Conditions 99	
4.2	Characteristics of Computation Algorithms 105	
4.3	Numerical Procedures for Heat-Convection Procedures	
	with Low and Medium Rates 109	
4.4	High-Rate Convection Processes 116	
4.5	Numerical Analysis of Steady-State Convective	
	Problems 122	
4.6	Convective Heat Transfer in Compressible Media 125	
Chapter 5	CONCLUSION	131
5.1	General Recommendations for the Application of	
	Finite-Difference Techniques to Heat-Transfer	
	Problems 131	
	References 135	
	Index 139	