
TABLE OF CONTENTS

	PREFACE	VII
CHAPTER 1	CONTINUOUS MEDIA	1
	1.1 Objectives	1
	1.2 Conservation and Continuity Equations	2
	1.3 Constitutive Equations	25
	1.4 Boundary and Initial conditions	35
	1.5 Exercises	44
	1.6 Bibliography	45
CHAPTER 2	THE FINITE DIFFERENCE METHOD	47
	2.1 Objectives	47
	2.2 One Dimensional Case	48
	2.3 Two Dimensional Problems	68
	2.4 Some Other Aspects of FDM.....	81
	2.5 Example	89
	2.6 Exercises	91
	2.7 Bibliography	92
CHAPTER 3	THE FINITE ELEMENT METHOD	93
	3.1 Objectives	93
	3.2 General Principles: Geometric Discretization and Integration	94
	3.3 Obtaining and Discretizing the Integral Form for a Scalar Problem: a Chemical Diffusion Example	111
	3.4 Solution of a Vector Problem: Mechanical Equilibrium Example	117
	3.5 Implementation	129
	3.6 Non Stationary Problems	139
	3.7 Exercises	146
	3.8 Bibliography	147
CHAPTER 4	ELEMENTS OF NUMERICAL ALGORITHMS	149
	4.1 Objectives	149
	4.2 Methods for Generating Meshes	150
	4.3 Solution Methods for Linear Systems	173
	4.4 Storage of Matrices in Memory	189

	4.5 Non Linear Problems	198
	4.6 Exercises	204
	4.7 Bibliography	205
CHAPTER 5	PHASE TRANSFORMATIONS	207
	5.1 Objectives	207
	5.2 State Equations	208
	5.3 Initial and Boundary Conditions	240
	5.4 Numerical Treatment	253
	5.5 Examples	266
	5.6 Exercises	284
	5.7 Bibliography	285
CHAPTER 6	DEFORMATION OF SOLIDS	287
	6.1 Objectives	287
	6.2 Constitutive Equations	287
	6.3 Boundary Conditions	310
	6.4 Numerical Treatment	318
	6.5 Examples	332
	6.6 Exercises	362
	6.7 Bibliography	363
CHAPTER 7	INCOMPRESSIBLE FLUID FLOW	365
	7.1 Objectives	365
	7.2 Constitutive Equations	366
	7.3 Boundary and Initial Conditions	380
	7.4 Numerical Treatment of the Navier-Stokes Problem	387
	7.6 Examples	423
	7.7 Exercises	442
	7.8 Bibliography	444
CHAPTER 8	INVERSE METHODS	447
	8.1 Objectives	447
	8.2 A Simple Linear One Dimensional Problem	448
	8.3 A Non Linear One Dimensional Problem	452
	8.4 Inverse Method with Time Independent Parameters	457
	8.5 Inverse Method with Time Dependent Parameters	464
	8.6 Examples	468
	8.7 Exercises	473
	8.8 Bibliography	475
CHAPTER 9	STOCHASTIC METHODS	477
	9.1 Objectives	477
	9.2 Generation of Random Numbers	478
	9.3 Integration by Stochastic Methods	485
	9.4 Solution of Systems of Equations	488
	9.5 Monte Carlo Method	492

9.6	Random Walkers Method	498
9.7	Cellular Automata Method	506
9.8	Examples	510
9.9	Exercises	514
9.10	Bibliography	515
CHAPTER 10	APPENDICES	517
10.1	Table of Symbols	517
10.2	Vector Calculus	521
10.3	Gauss Integration Method	525
10.4	Non Dimensional Numbers	531
10.5	Interpretation of the Terms of the Elementary Stiffness Matrix for a Diffusion Problem on a Triangular Linear Finite Element	532
	INDEX.....	535



<http://www.springer.com/978-3-540-42676-9>

Numerical Modeling in Materials Science and
Engineering

Rappaz, M.; Bellet, M.; Deville, M.

2003, XII, 540 p., Hardcover

ISBN: 978-3-540-42676-9