
Contents

Introduction	1
1 Pre-Requisites of Fixed Points	3
1.1 The Background of Metrical Fixed Point Theory	3
1.2 Fixed Point Iteration Procedures	15
1.3 Fixed Point Formulation of Typical Functional Equations.....	19
1.4 Bibliographical Comments	27
Exercises and Miscellaneous Results	28
2 The Picard Iteration	31
2.1 Banach's Fixed Point Theorem	31
2.2 Theorem of Nemytzki-Edelstein	34
2.3 Quasi-Nonexpansive Operators	36
2.4 Maia's Fixed Point Theorem	39
2.5 φ -Contractions	41
2.6 Generalized φ -Contractions	45
2.7 Weak Contractions	50
2.8 Bibliographical Comments	57
Exercises and Miscellaneous Results	59
3 The Krasnoselskij Iteration	63
3.1 Nonexpansive Operators in Hilbert Spaces	63
3.2 Strictly Pseudocontractive Operators	70
3.3 Lipschitzian and Generalized Pseudocontractive Operators....	71
3.4 Pseudo φ -Contractive Operators.....	77
3.5 Quasi Nonexpansive Operators	79
3.6 Bibliographical Comments	83
Exercises and Miscellaneous Results	85

4	The Mann Iteration	89
4.1	The General Mann Iteration	89
4.2	Nonexpansive and Quasi-Nonexpansive Operators	93
4.3	Strongly Pseudocontractive Operators	104
4.4	Bibliographical Comments	109
	Exercises and Miscellaneous Results	111
5	The Ishikawa Iteration	113
5.1	Lipschitzian and Pseudo-Contractive Operators in Hilbert Spaces	114
5.2	Strongly Pseudo-Contractive Operators in Banach Spaces	117
5.3	Nonexpansive Operators in Banach Spaces Satisfying Opial's Condition	121
5.4	Quasi-Nonexpansive Type Operators	127
5.5	The Equivalence Between Mann and Ishikawa Iterations	131
5.6	Bibliographical Comments	132
	Exercises and Miscellaneous Results	134
6	Other Fixed Point Iteration Procedures	135
6.1	Mann and Ishikawa Iterations with Errors	135
6.2	Modified Mann and Ishikawa Iterations	139
6.3	Ergodic and Other Fixed Point Iteration Procedures	142
6.4	Perturbed Mann Iteration	145
6.5	Viscosity Approximation Methods	147
6.6	Bibliographical Comments	151
	Exercises and Miscellaneous Results	155
7	Stability of Fixed Point Iteration Procedures	157
7.1	Stability and Almost Stability of Fixed Point Iteration Procedures	157
7.2	Weak Stability of Fixed Point Iteration Procedures	162
7.3	Data Dependence of Fixed Points	166
7.4	Sequences of Applications and Fixed Points	172
7.5	Bibliographical Comments	175
	Exercises and Miscellaneous Results	176
8	Iterative Solution of Nonlinear Operator Equations	179
8.1	Nonlinear Equations in Arbitrary Banach Spaces	180
8.2	Nonlinear Equations in Smooth Banach Spaces	186
8.3	Nonlinear m -Accretive Operator Equations in Reflexive Banach Spaces	193
8.4	Bibliographical Comments	196
	Exercises and Miscellaneous Results	197

9	Error Analysis of Fixed Point Iteration Procedures	199
9.1	Rate of Convergence of Iterative Processes	200
9.2	Comparison of Some Fixed Point Iteration Procedures for Continuous Functions	202
9.3	Comparing Picard, Krasnoselskij and Mann Iterations in the Class of Lipschitzian Generalized Pseudocontractions	207
9.4	Comparing Picard, Mann and Ishikawa Iterations in a Class of Quasi Nonexpansive Maps	210
9.5	The Fastest Krasnoselskij Iteration for Approximating Fixed Points of Strictly Pseudo-Contractive Mappings	213
9.6	Empirical Comparison of Some Fixed Point Iteration Procedures	216
9.7	Bibliographical Comments	218
	Exercises and Miscellaneous Results	219
	References	221
	List of Symbols	305
	Author Index	307
	Subject Index	317

