

TABLE OF CONTENTS

INTRODUCTION	1
ACKNOWLEDGEMENTS	2
Part I. BASIC RESULTS OF FUNCTIONAL ANALYSIS	3
CHAPTER	
1.0 Vector spaces	3
2.0 Operators on vector spaces	8
3.0 The geometric series and its application	13
Approximation of linear operator equations	15
4.0 Principle of uniform boundedness	18
Application to numerical integration	20
5.0 Compact integral operators	23
Integral operators on $C[a,b]$	24
The Fredholm alternative theorem	26
Summary of other theoretical results	29
Part II. NUMERICAL METHODS FOR COMPACT INTEGRAL EQUATIONS OF THE SECOND KIND	32
1.0 Successive approximations	32
2.0 Degenerate kernel and projection methods	37
2.1 Degenerate kernel methods	37
Solution of degenerate kernel equation	39
Forming degenerate kernel approximations	42
Orthonormal expansions	46
Interpolatory approximations	47

TABLE OF CONTENTS (Continued)

CHAPTER

2.2	Projection methods	50
	Collocation method	54
	Numerical examples	58
	Galerkin method	62
	Regularizing $(\lambda - \mathcal{K})x = y$	71
2.3	Stability of linear systems	73
	Collocation method	76
	Galerkin method	79
	Discussion of literature	84
3.0	The Nyström method	88
3.1	An abstract error analysis	93
	Perturbation theorem	94
	Collectively compact operator theory	96
	Application of abstract error analysis	99
	Numerical examples	102
	Stability of linear system	105
3.2	Singular kernels and product integration	106
	Product integration method 1	106
	Error analysis	108
	Calculation of weights	113
	Numerical examples	114
	Product integration method 2	117
	Numerical examples	119
	Error analysis	122

TABLE OF CONTENTS (Continued)

CHAPTER

3.3	Connections with the collocation method	123
	Discussion of literature	125
4.0	Iterative variants of direct methods	127
4.1	An iterative variant of the degenerate kernel method	128
	Numerical example	132
4.2	Iterative variants of the Nyström method	138
	Method 1	139
	Method 2	142
	Method 3	147
	Numerical examples	152
	Discussion of literature	162
5.0	Automatic algorithms	164
5.1	An Automatic program based on Simpson's rule	165
	Numerical examples	171
5.2	An automatic program based on Gaussian quadrature	175
	Numerical examples	179
5.3	The computer programs	187
	Flowchart of IESIMP	189
	Explanation of program variable names	191
	Program IESIMP	192
	Program IEGAUS	204
	References	223