

CONTENTS

Preface	ix
Preliminaries	xiii
Part A. (m, s)-Splines	3
Introduction	3
I. The spaces $X^{m,s}$	5
1. Definition	5
2. Imbeddings and norms	7
II. Interpolating (m, s)-splines	13
1. Definition and first properties	13
2. The space of (m, s) -spline functions. Examples	15
3. Other problems. Splines defined by local mean values	22
4. Computation of interpolating splines	25
5. A convergence result	27
6. Auxiliary results	31
7. Estimates of the approximation error	35
III. Smoothing (m, s)-splines	39
1. Definition and first properties	39
2. Computation of smoothing splines	40
3. Convergence results	42
4. Estimates of the approximation error	46
5. Convergence for noisy data	50
IV. (m, l, s)-Splines	53
1. The spaces $X^{m,l,s}$	53
2. Interpolating (m, l, s) -splines	54

3. Smoothing (m, l, s) -splines	55
Part B. D^m-Splines over a Bounded Domain of \mathbb{R}^n	59
Introduction	59
V. D^m-splines over Ω	61
1. Interpolating D^m -splines	61
2. The space of D^m -splines	64
3. Smoothing D^m -splines	65
4. Convergence and error estimates	66
VI. Discrete D^m-splines	69
1. The finite element framework	69
2. Discrete interpolating D^m -splines	72
2.1. Definition and properties	72
2.2. Convergence and error estimates	74
3. Discrete smoothing D^m -splines	80
3.1. Definition and properties	80
3.2. Convergence and error estimates	82
VII. Univariate D^m-splines	89
1. Characterization and explicit form	89
2. Computation of D^m -splines	93
3. Cubic splines	95
3.1. Natural cubic splines	96
3.2. Clamped cubic splines	97
3.3. The basis of cubic B -splines	98
4. Tensor product of univariate D^m -splines	99
Part C. Applications of Discrete D^m-Splines	103
Introduction	103

VIII. Construction of explicit surfaces from large data sets	105
1. Formulation of the problem	105
2. The fitting method	105
3. Examples of finite elements	107
4. Convergence results	110
5. An interpolation-smoothing mixed method	110
6. Numerical results	113
IX. Approximation of faulted explicit surfaces	131
1. Formulation of the problem	131
2. Spaces of functions on Ω'	133
2.1. Definition of the discontinuity set F	133
2.2. Spaces $C_F^k(\Omega')$, $H^m(\Omega')$ and $H^m(\Omega') \cap C^r(\overline{\Omega})$	134
3. D^m -splines over Ω'	136
4. Discrete D^m -splines	140
5. Global convergence	145
6. Local convergence	148
7. Approximation of explicit surfaces with vertical faults	157
8. Numerical results	160
X. Fitting an explicit surface along a set of curves	175
1. Formulation of the problem	175
2. Approximation of $\ \cdot\ _{0,F}^2$	177
3. Spline fitting	179
4. Convergence of the approximation	183
5. Numerical results	188
XI. Fitting an explicit surface over an open set	199
1. Formulation of the problem	199
2. Spline fitting	199
3. Convergence of the approximation	204
4. Numerical results	208

XII. Approximation of parametric surfaces	219
1. Introduction	219
2. Formulation of the problem	220
3. Spline fitting	222
4. Convergence of the approximation	225
5. Numerical results	227
Bibliography	247
Index	257