

Contents

1	Introduction	11
2	Foundations I: Basic Ideas	15
2.1	The Idea of Subdivision	16
2.2	Review of Splines	20
2.2.1	Piecewise Polynomial Curves	20
2.2.2	Definition of B-Splines	22
2.2.3	Refinability of B-splines	24
2.2.4	Refinement for Spline Curves	25
2.2.5	Subdivision for Spline Curves	27
2.3	Subdivision as Repeated Refinement	28
2.3.1	Discrete Convolution	28
2.3.2	Convergence of Subdivision	30
2.3.3	Summary	33
2.4	Analysis of Subdivision	34
2.4.1	Invariant Neighborhoods	34
2.4.2	Eigen Analysis	38
2.4.3	Convergence of Subdivision	40
2.4.4	Invariance under Affine Transformations	40
2.4.5	Geometric Behavior of Repeated Subdivision	42
2.4.6	Size of the Invariant Neighborhood	42
2.4.7	Summary	44

3	Subdivision Surfaces	45
3.1	Subdivision Surfaces: an Example	46
3.2	Natural Parameterization of Subdivision Surfaces	48
3.3	Subdivision Matrix	51
3.4	Smoothness of Surfaces	54
3.4.1	C^1 -continuity and Tangent Plane Continuity	54
3.5	Analysis of Subdivision Surfaces	55
3.5.1	C^1 -continuity of Subdivision away from Extraordinary Vertices	57
3.5.2	Smoothness Near Extraordinary Vertices	58
3.5.3	Characteristic Map	59
3.6	Piecewise-smooth surfaces and subdivision	61
4	Subdivision Zoo	65
4.1	Overview of Subdivision Schemes	65
4.1.1	Notation and Terminology	68
4.2	Loop Scheme	70
4.3	Modified Butterfly Scheme	73
4.4	Catmull-Clark Scheme	73
4.5	Kobbelt Scheme	76
4.6	Doo-Sabin and Midedge Schemes	78
4.7	Limitations of Stationary Subdivision	78
5	Evaluation of Subdivision Surfaces	
6	Implementing Subdivision and Multiresolution Meshes	
7	Interpolatory Subdivision for Quad Meshes	
8	A Variational Approach to Subdivision	
9	Subdivision Cookbook	
10	Subdivision Surfaces in the Making of Gerl's Game	