

Arturo Tedeschi

Parametric Architecture
with Grasshopper®
Primer

Edizioni **Le Penseur**

Contents

Foreword	7
Introduction - What's Grasshopper	11
1. What's an algorithm	15
1.1. Algorithms	15
2. The very beginning	19
2.1. Installation	19
2.2. User interface	19
<i>Components' panel</i>	11
<i>Working area</i>	22
<i>(canvas)</i>	
2.3. Components and data	24
<i>Data's local definition</i>	24
<i>Components'</i>	26
<i>Parameters</i>	30
<i>Working status</i>	31
<i>Showed from</i>	
<i>Direct import</i>	34
<i>connection components different colours</i>	
<i>Rhino</i>	
2.4. Data matching	35
2.5. Parametric control. Remote Control Panel	38
2.6. Algorithms' save and conversion	40
<i>Save</i>	40
<i>Bake: algorithms' conversion in models for Rhino</i>	40
2.7. Display and control	41
<i>Draw Fancy Wires</i>	41
Icons	42
<i>Enable/Disable</i>	42
<i>Enable/Disable</i>	43
<i>Navigate/Views</i>	43
<i>Focus</i>	44
<i>Hidden display</i>	45
<i>Cluster</i>	46
3. Mathematical and logical functions	49
3.1. Mathematics	49
3.2. Mathematics and Grasshopper	49
3.3. Numerical sequences	51
<i>Series - Numerical sequence</i>	52
<i>Range</i>	54
<i>Random - random numbers</i>	55
<i>Fibonacci series</i>	55

Contents

3.4. Mathematical functions	56
Component function $F_1(x)$	56
Component Function	59
Function	$F_2(x,y)$
3.5. Logical functions: Boolean operators	61
3.6. Exclusion lists and filters	63
List Item	64
List Length	65
Reverse	List
Shift List	65
Split List	66
Cull Nth	67
Cull Pattern	68
Dispatch	70
4. Curves and surfaces	71
4.1. Representations	71
4.2. Theoretical outlines	71
Parametric representation of a curve	71
The notion of curvature: plane curves	73
Surface's curvature	73
Isocurves	75
4.3. Curve analysis in Grasshopper	76
Evaluate Curve	76
Curvature	79
Curvature Graph	80
4.4. Surfaces' analysis in Grasshopper	80
Divide Surface	80
Evaluate Surface	81
Principal Curvature	82
Surface Curvature	82
Isotrim (SubSrf) - Extract an isoparametric subset of a surface	84
5. Transformations	89
5.1. Geometrical transformations	89
Classifications	89
5.2. Transformations with shape preservation	90
Vectors	90
Translations: Move	91
Rotations: Rotate Axis	92
Rotations: Rotate	93
Orient	94
5.3. Transformations with shape variation	95
Resizing: Scale	95
Graph Mapper	98
Deformations: Morphing	100
5.4. Paneling	102
5.5. Image Sampler	111
6. Exercise: Turning Torso	115
6.1. Introduction	115
6.2. Turning Torso	116
6.3. Steps	116
Collecting information about the building	116
Definition of the typical plan	117
Transformation of floors	118
Simplified modeling of the envelope	121
Modeling of the detail of the exterior surface	123

7. Data Tree		129					
7.1. Concepts		129					
7.2. Display		132					
7.3. Components		134					
<i>Flatten</i>	<i>Tree</i>	134					
<i>Merge</i>		138					
<i>Graft</i>	<i>Tree</i>	140					
<i>Tree</i>	<i>Branch</i>	143					
<i>Explode</i>	<i>Tree</i>	144					
<i>Path Mapper</i>		145					
7.4. Lexical rules		151					
8. Attractors		161					
8.1. Definitions		161					
<i>Attractor point</i>		161					
<i>Attractor</i>	<i>curve</i>	64					
1							
9. Mesh		167					
9.1. NURBS and polygonal surfaces		167					
9.2. Mesh		170					
<i>Topology</i>		170					
9.3. Triangulations		173					
<i>Delaunay</i>		174					
<i>Voronoi</i>		176					
9.4. Approximation		177					
9.5. Subdivision		178					
<i>Subdivision surfaces</i>	<i>surfaces</i>	<i>with</i>	<i>the</i>	<i>Loop's</i>	<i>method</i>	1	79
<i>Subdivision surfaces</i>	<i>surfaces</i>	<i>with</i>	<i>Catmull-Clark's</i>	<i>method</i>	1	84	
10. Fabrication		185					
10.1. Project and fabrication		185					
10.2. Matters of scale		186					
10.3. Two case histories		188					
10.4. Exercise: modeling a complex covering		191					
<i>Covering</i>	<i>components'</i>	<i>fabrication</i>	191				
<i>Production</i>	<i>of</i>	<i>structural</i>	<i>elements</i>	194			
10.5. Conclusions		204					
Bibliography		205					
Publications		205					
Web references		206					