

CONTENTS

| | |
|--|-----|
| Preface | 8 |
| Foreword | 9 |
| Acknowledgements | 10 |
| Introduction | 11 |
| | |
| <i>Chapter 1. Curves.</i> | 13 |
| 1.1. Curves | 13 |
| 1.2. Analytic Curves | 17 |
| 1.3. Curves Constructed on a Set of Points. | 19 |
| 1.4. Bezier Curves | 27 |
| 1.5. Bezier Curves and Conical Sections | 31 |
| 1.6. Rational Bezier Curves | 39 |
| 1.7. Divided Differences | 42 |
| 1.8. <i>B</i> -Splines | 47 |
| 1.9. <i>B</i> -Spline Curves | 54 |
| 1.10. De Boor's Algorithm | 59 |
| 1.11. Point and Knot Insertion in <i>B</i> -Spline Curve | 61 |
| 1.12. Examples of <i>B</i> -Spline Curves. | 64 |
| 1.13. <i>B</i> -Spline Curves and Bezier Curves | 66 |
| 1.14. Special Cases of <i>B</i> -Spline Curves | 71 |
| 1.15. Curves Constructed on Other Curves | 78 |
| 1.16. Contour | 83 |
| | |
| <i>Chapter 2. Surfaces</i> | 85 |
| 2.1. Surfaces | 85 |
| 2.2. Analytic Surfaces | 96 |
| 2.3. Surfaces Constructed by Curve Translation | 100 |
| 2.4. Surfaces Constructed on a Set of Curves | 104 |
| 2.5. Surfaces Constructed on a Mesh of Curves | 110 |
| 2.6. Surfaces Constructed on a Set of Points. | 117 |
| 2.7. Bezier Surfaces | 120 |
| 2.8. <i>B</i> -Spline Surfaces | 122 |
| 2.9. <i>T</i> -Spline Surfaces | 127 |
| 2.10. Surfaces of Triangular Form | 131 |
| 2.11. Triangular Bezier Surfaces. | 135 |
| 2.12. Homogeneous Divided Differences | 140 |
| 2.13. Homogeneous Simplex Splines | 147 |
| 2.14. <i>S</i> -Spline Surfaces. | 152 |
| 2.15. Surfaces Constructed on Other Surfaces. | 154 |
| 2.16. Supple Surfaces | 157 |
| 2.17. Surface Based on Triangulation | 158 |
| 2.18. Surface with Arbitrary Boundary | 160 |

| | |
|--|-----|
| Chapter 3. Constructions on Curves and Surfaces | 163 |
| 3.1. Projection of a Point on a Curve. | 163 |
| 3.2. Projection of a Point on a Surface. | 166 |
| 3.3. Intersection Points of Curves | 170 |
| 3.4. Intersection Points of a Surface and a Curve | 173 |
| 3.5. Intersection Points of Three Surfaces | 175 |
| 3.6. Curves on Surfaces | 176 |
| 3.7. Curves of Intersection of Surfaces | 181 |
| 3.8. An Algorithm To Construct Intersection Curves | 185 |
| 3.9. Fillet Surfaces | 189 |
| 3.10. Chamfer Surfaces | 197 |
| 3.11. Position of a Point Relative to a Surface. | 198 |
| 3.12. Searching for Initial Approximations | 199 |
| 3.13. Precision of Geometric Construction | 201 |
| | |
| Chapter 4. Geometric Model | 204 |
| 4.1. Shells | 204 |
| 4.2. Properties of Shells | 206 |
| 4.3. Manifold Shells | 210 |
| 4.4. Solids in Geometric Modeling | 211 |
| 4.5. Data Structures | 212 |
| 4.6. Elementary Solids. | 213 |
| 4.7. Solids Constructed by Curve Translation | 218 |
| 4.8. Lofted Solids | 221 |
| 4.9. Solids Constructed from Surfaces. | 223 |
| | |
| Chapter 5. Geometric Model Building | 225 |
| 5.1. Methods of Geometric Modeling. | 225 |
| 5.2. Boolean Operations on Solids | 226 |
| 5.3. An Algorithm for Boolean Operations | 233 |
| 5.4. Sectioned Solids. | 237 |
| 5.5. Symmetric Solids | 238 |
| 5.6. Solids with Supplementary Elements. | 241 |
| 5.7. Offset Solids | 243 |
| 5.8. Thin-Shell Solids | 245 |
| 5.9. Filleting Solid Edges | 247 |
| 5.10. Edge Filleting Algorithm for Solids | 252 |
| 5.11. Construction of Edge Chamfers of Solids | 253 |
| 5.12. Direct Modeling | 254 |
| 5.13. Transformations of Solids. | 256 |
| | |
| Chapter 6. Geometric Constraints | 259 |
| 6.1. Geometric Model Control | 259 |
| 6.2. Creation of Geometric Constraints | 261 |
| 6.3. Positioning of a Set of Solids | 264 |
| 6.4. Solution of Geometric Constraints Equations | 267 |
| 6.5. The Conservative Method. | 268 |
| 6.6. The Decomposition Method. | 270 |

| | |
|---|-----|
| Chapter 7. Geometric Model Application | 274 |
| 7.1. Geometric Model Content. | 274 |
| 7.2. Geometric Model Uses | 275 |
| 7.3. Vector Image Construction | 276 |
| 7.4. Optical Properties Modeling | 280 |
| 7.5. Raster Image Construction | 285 |
| 7.6. Triangulation | 290 |
| 7.7. Surface Triangulation | 296 |
| 7.8. Shell Triangulation | 298 |
| 7.9. Inertial Properties | 299 |
| 7.10. Calculation of Inertial Characteristics. | 302 |
| 7.11. Principal Moments of Inertia | 306 |
| | |
| Appendix. Coordinate Systems | 313 |
| A.1. Affine Coordinates. | 313 |
| A.2. Modification of Vectors and Points | 316 |
| A.3. Homogeneous Coordinates | 318 |
| A.4. Curvilinear Coordinates | 320 |
| A.5. Differentiation in Curvilinear Coordinates | 324 |
| A.6. Tensors in Curvilinear Coordinates | 328 |
| A.7. Examples of Tensors | 333 |
| A.8. Orthogonal Curvilinear Coordinates. | 339 |
| | |
| References | 344 |