Mathematical aspects of geometric modeling

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Abstrak

This monograph examines in detail certain concepts that are useful for the modeling of curves and surfaces and emphasizes the mathematical theory that underlies these ideas. The two principal themes of the text are the use of piecewise polynomial representation (this theme appears in one form or another in every chapter), and iterative refinement, also called subdivision. Here, simple iterative geometric algorithms produce, in the limit, curves with complex analytic structure.
In the first three chapters, the de Casteljau subdivision for Bernstein-Bezier curves is used to introduce matrix subdivision, and the Lane-Riesenfield algorithm for computing cardinal splines is tied into stationary subdivision. This ultimately leads to the construction of prewavelets of compact support. The remainder of the book deals with concepts of "visual smoothness" of curves, along with the intriguing idea of generating smooth multivariate piecewise polynomials as volumes of "slices" of polyhedra. The final chapter contains an evaluation of polynomials by finite recursive algorithms. Each chapter contains introductory material as well as more advanced results.