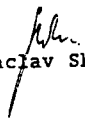


Foreword

This volume contains contributions presented at the Winter School of Computer Graphics and CAD Systems 94 international conference held at the University of West Bohemia, Plzeň, Czech Republic.

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Triangular Patches under Tension

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Abstract: Given a triangular surface scheme that only approximates the initial data the resulting surfaces do not reflect the shape of control vertices as much as the user would have liked. By supplying tension parameters, or what in this case might be called "shape" parameters, the user is able to force the triangular surface patch to follow the control vertices as closely as desired without moving or introducing additional control points.

Introduction

Let n be a positive integer and for each set of nonnegative integers i, j, k such that $i+j+k = n$, let $\alpha_{ijk} > 0$, define

$$Q_{ijk}(\alpha, u, v, w) = \alpha_{ijk} (n!/i!j!k!) u^i v^j w^k / d(\alpha, u, v, w),$$

where

$$d(\alpha, u, v, w) = \sum_{i+j+k=n} \alpha_{ijk} (n!/i!j!k!) u^i v^j w^k,$$

the last sum being taken over all nonnegative integers i, j, k summing to n . Thus the surface patch

$$Q(\alpha, u, v, w) = \sum_{i+j+k=n} Q_{ijk}(\alpha, u, v, w) P_{ijk}$$

clearly interpolates to the points $P_{n00}, P_{0n0}, P_{00n}$, where as usual the P_{ijk} are labeled as in the typical Bezier triangle method [Farin 1983] (see Fig. 7.1). The patches above are two-variable functions, e.g. if u, v are given such that $u \in [0, 1], v \in [0, 1-u]$, then $w = 1 - u - v$ is determined. Triangular patches have been subject of an extensive research since in certain situations we need to draw non-rectangular patches. These surfaces have similar properties as those of tensor product Bezier patches, e.g. convex hull property, affine invariance, and the most techniques used in rectangular patch geometry can be extended to triangular ones, e.g. recursive definition of surface points [de Casteljau Algorithm], degree elevation and subdivision.