Constrained multi-degree reduction of triangular Bézier surfaces using dual Bernstein polynomials

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Abstract

We propose a novel approach to the problem of multi-degree reduction of Bézier triangular patches with prescribed boundary control points. We observe that the solution can be given in terms of bivariate dual discrete Bernstein polynomials. The algorithm is very efficient thanks to using recursive properties of these polynomials. The complexity of the method is $\mathcal{O}(n^2m^2)$, n and m being degree of the input and output Bézier surface, respectively. If the approximation—with appropriate boundary constraints—is performed for each patch of several smoothly joined triangular Bézier surfaces, the result is a composite surface of global C^r continuity with a prescribed order r. Some illustrative examples are given.

Key words: Triangular Bézier surface, Multi-degree reduction, Bivariate dual Bernstein basis, Bivariate dual discrete Bernstein basis, Bivariate Jacobi polynomials, Bivariate Hahn polynomials.

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