G^1 Surfaces via Generalised Multisided Gregory Patches

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Figure 1: From left to right: The input mesh (Spot; 56 triangles, 634 quads, 40 pentagons, and 4 hexagons), shading on Gregory S-patches, shading on Gregory generalised Bézier patches, reflection lines on Gregory S-patches, and reflection lines on Gregory generalised Bézier patches.

We propose two generalisations of Gregory patches to faces of any valency [1] by using generalised barycentric coordinates in combination with two kinds of multisided Bézier patches; see Figure 1. Our first construction builds on S-patches [2] to generalise triangular Gregory patches. The local construction of Chiyokura and Kimura [3] providing G^1 continuity between adjoining Bézier patches is generalised so that the novel Gregory S-patches of any valency can be smoothly joined to one another. Our second construction makes a minor adjustment to the generalised Bézier patch structure [4] to allow for cross-boundary derivatives to be defined independently per side. We show that the corresponding blending functions have the inherent ability to blend ribbon data much like the rational blending functions of Gregory patches. Both constructions take as input a polygonal mesh with vertex normals and provide G^1 surfaces interpolating the input vertices and normals. Due to the full locality of the methods, they are well suited for geometric modelling as well as computer graphics applications relying on hardware tessellation.

Joint work with: Gerben J. Hettinga, Johann Bernoulli Institute, University of Groningen.

References

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