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Stitching of Arbitrary Parametric Surface Patches with G^1 Continuity Using B-splines

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ABSTRACT

In computer graphics, the construction of complete 3-dimensional objects requires the blending of several incompatible (mathematical properties are different) surface patches such as Bezier, B-spline, and NURBS surfaces. The blending process often results in undesirable geometric properties along the connected boundaries such as sharp edges, gaps, overlaps. In this paper, we propose an efficient surface blending method for stitching of arbitrary parametric surfaces that guarantees G^1 continuity along stitching boundaries. The surface patching problem between two-surface patches is investigated for following special cases: sharp edges, gaps and overlaps. The proposed surface stitching method is to construct a B-spline blending surface between base surfaces through incorporating the following conditions: i) Determine stitching boundaries on base surfaces; ii) Control points of B-spline blending surface are constructed from the base surfaces' data points and the interpolation scheme; iii) The knot vectors of the B-spline blending surfaces are organized in such way that full multiplicity is achieved at their end-knots; iv) The surface order along the stitching boundary directions is set to 2; and v) Parametric conditions along stitching boundary directions for both B-spline blending surface and base surfaces are forced to be uniform. The main advantages of the proposed methodology are: i) Capability of blending surfaces at the local level; and ii) Blending different kinds of surface patches such as Bezier and B-spline.

Keywords: B-spline, Bezier surface, G^1 blending, sharp edges.

Mathematics Subject Classification: 68U05, 65D18

1. INTRODUCTION

In multidisciplinary areas, parametric curves and surfaces have a wide range of applications (Wan Din et al. 2013, and Zakaria et al. 2013). In computer graphics, the construction of complete 3-dimensional objects requires the blending of several incompatible (mathematical properties are different) surface