Some results on curves and surfaces modeling

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Abstract. We do some researches on subdivision surfaces frame and Bézier frame. For Catmull-Clark surfaces, we obtain the rate of convergence of control meshes of Catmull-Clark surfaces by introducing the concept of neighbor points and some new combinations of control points. We derive a computational formula of subdivision depth for Catmull-Clark surfaces. For Loop surfaces, we prove that the control meshes converge to the limit surface at an exponential rate. Our estimate is optimal. Furthermore, by the rate of convergence we derive a computational formula of subdivision depth for Loop subdivision surfaces. We also propose an exact and explicit parameterization formula for Loop subdivision surfaces by utilizing the discrete Fourier transform (DFT) and inverse transform (IDFT).

For Bézier frame, we propose Bézier curves with $n$ shape parameters and triangular Bézier surfaces with $3n(n+1)/2$ shape parameters. We discuss the geometric significance of the shape parameters and the geometric properties of these curves and surfaces. We study some algorithms of trimming Bézier patches on Bézier surfaces by means of blossoming and parameter transformation.

We also do some researches on Approximation Theory and Frame Theory.