The Generalized Classes of Linear Symmetric Subdivision Schemes Free from Gibbs Oscillations and Artifacts in the Fitting of Data

ABSTRACT

This paper presents the advanced classes of linear symmetric subdivision schemes for the fitting of data and the creation of geometric shapes. These schemes are derived from the B-spline and Lagrange's blending functions. The important characteristics of the derived schemes, including continuity, support, and the impact of parameters on the magnitude of the artifact and Gibbs oscillations are discussed. Schemes additionally generalize various subdivision schemes. Linear symmetric subdivision schemes can produce Gibbs oscillations when the initial data is taken from discontinuous functions. Additionally, these schemes may generate unwanted artifacts in the limit curve that do not exist in the original polygon. One solution is to use non-linear schemes, but this approach increases the computational complexity of the scheme. An alternative approach is proposed that involves modifying the linear symmetric schemes by introducing parameters into the linear rules. The suitable values of these parameters reduce or eliminate Gibbs oscillations and artifacts while still using linear symmetric schemes. Our approach provides a balance between reducing or eliminating Gibbs oscillations and artifacts while maintaining computational efficiency. In the second half, the piecewise parametric polynomial curves by using the blending polynomials used in the symmetric schemes are also presented. The majority of the properties of uniform quadratic and cubic B-splines with $G2$ geometric continuities are inherited by these polynomial curves. These curves can also be used for local interpolation of the control points with $G2$ continuity. Furthermore, by adjusting the value of the shape parameter, uniform cubic and quadratic B-spline curves can also be produced. These polynomial curves also satisfy the shape preserving properties of initial data.