
Abstract

The presented work deals with subdivision schemes for curves and surfaces that employ conic sections as the fundamental tool of refinement. After an overview of existing non-linear methods for planar curves, two new non-linear schemes are introduced: the **parabola-preserving scheme** and the **first-order scheme**. Both of these methods are inspired by the works of Jüttler and Chalmovianský. For the parabola-preserving scheme, several properties have been mathematically established, namely conic preservation, convergence, finite length of the limit curve, G^1 continuity, and Euclidean invariance. For the first-order scheme, conic preservation has been proven, while convergence has so far been confirmed experimentally. Due to the structural similarity of the two schemes, it is expected that further properties can be derived by analogous methods.

The parabola-preserving scheme is subsequently extended to three-dimensional space, where it is applied to spatial curves and, by means of tensor products, also to surfaces. This part of the work builds upon the method of Dyn and Lipovetsky, which is based on refinement by circles in 3D. The obtained results are of an experimental nature, but they indicate convergence of the proposed scheme. In particular, for sufficiently dense input data representing a parametrized object, the scheme produces limit curves and surfaces that approximate the original object with high accuracy.

Keywords: subdivision schemes, curve refinement, surface refinement, conic sections, convergence, geometric modeling