

# Application of Spline Implicitization

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## Abstract

In [1], [2], we discuss the problem of constructing low degree *spline implicitization* for parametric planar curves. A spline implicitization is a partition of the plane into polygonal segments, and a bivariate polynomial for each segment, such that the collection of the zero counters approximately describes the given curve. The polynomial pieces form a global  $C^m$  spline function, for certain choice of  $m$ . We restrict ourselves to the cases  $m = 0, 1$ .

Multigrid hierarchy of functions plays a fundamental role in the area of numerical simulation. In this poster, as an extended research of the  $C^1$  spline approximation technique, we propose a method for generating a hierarchy of planar shapes which may help in the generating a hierarchy of functions. A hierarchy of shapes is a sequence of approximation of fixed shape which is simpler and simpler, see Fig. 1.

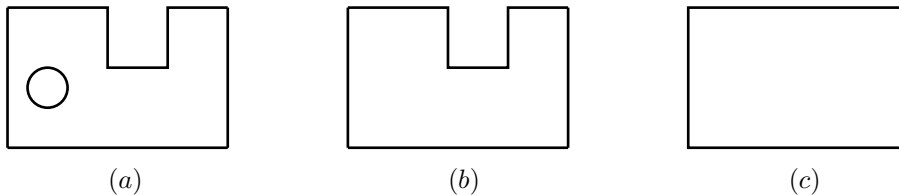


Figure 1 A planar shape (a) and its hierarchy of shapes (b, c)

Starting with a planar shape defined by a set of parametric planar curves, first, we apply the  $C^1$  spline implicitization technique for each these parametric planar curve. Then, using the quadratic spline wavelets, we generate a hierarchy of shapes. The main idea is to set all levels detail coefficients to be zero. Going from level to a lower level, we obtain a hierarchy of shapes. An example is shown in Fig. 2. It should be noted that: this research is still incomplete and it is open for future investigation.

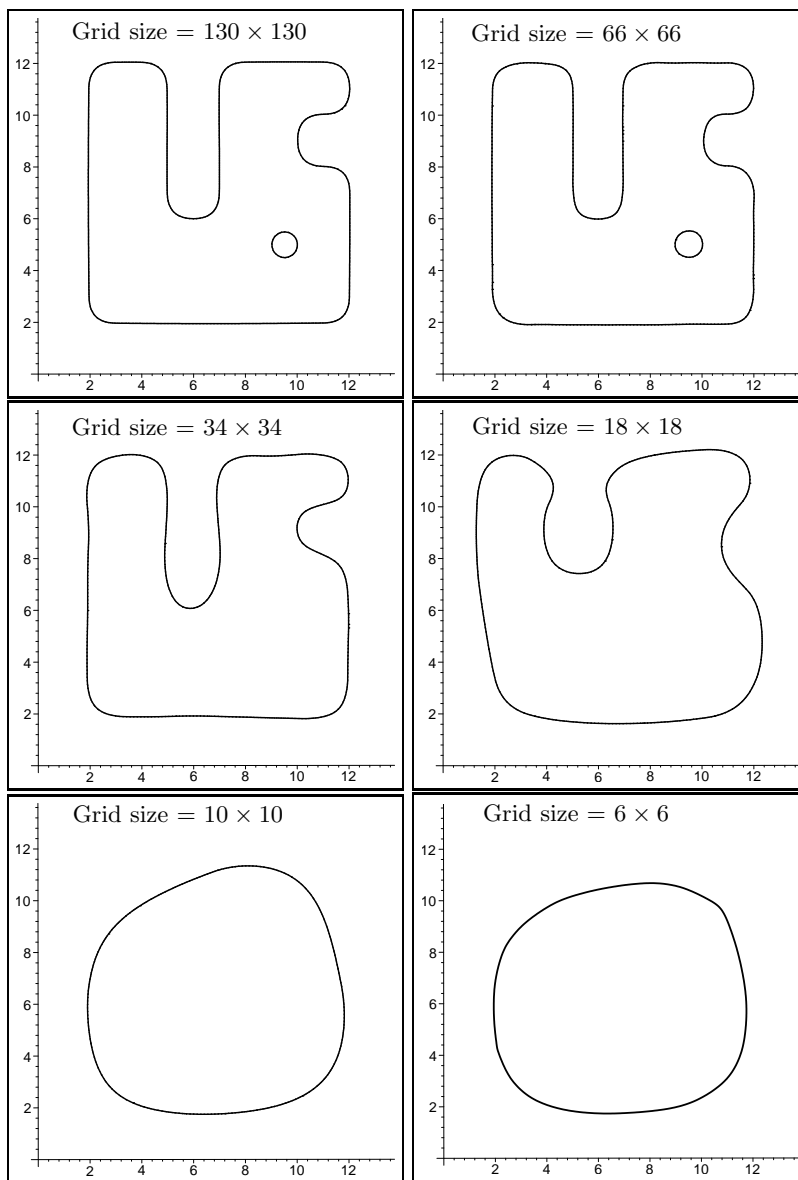


Figure 2. Hierarchically shapes structure of a planar shape

## References

- [1] B. Jüttler, J. Schicho and M. Shalaby, *Spline Implicitization of Planar Curves*. In T. Lyche, M. L. Mazure, and L.L. Schumaker, editors, *Curves and Surfaces Design: St. Malo 2002*, pages 225–234, Brentwood, 2003. Nashboro Press.
- [2] M. Shalaby, B. Jüttler and J. Schicho,  *$C^1$  Spline Implicitization of Planar Curves*. In F. Winkler, editor, *Automated Deduction in Geometry*, volume 2930 of *Lecture notes in Artificial Intelligence*, pages 161–177, Heidelberg, 2004. Springer.