Non-oscillatory surfaces generation using subdivision schemes

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The computational generation of curves and surfaces can be efficiently done by subdivision schemes. A well-known linear interpolatory scheme for the generation of $\mathcal{C}^1$ surfaces is the butterfly subdivision scheme [1], which is capable of exactly reproducing third degree bivariate polynomials (when the initial data is of this kind). However, as most of the linear interpolatory schemes, it produces oscillations when the initial data has large gradients. This is a usual situation when dealing with data coming from piecewise smooth function with discontinuities.

In the univariate case, the authors in [2] explain how to transform a linear oscillatory scheme into a non-linear non-oscillatory one. The key idea is to express the given scheme as a convex combination of other schemes based on smaller stencil and, then, replace the linear averages appearing in the convex combination by non-linear analogues.

Here, we extend the ideas of [2] to the bivariate case, in particular to triangular grids, and we design a non-linear non-oscillatory version of the butterfly subdivision scheme.

This work may have applications in data compression and in the numerical solution of PDEs such as conservation laws.

Joint work with: Costanza Conti

References

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[2] R. Donat, S. López-Ureña, M. Santágueda. A family of non-oscillatory 6-point interpolatory subdivision schemes. *Advances in Computational Mathematics, 43(4)*, 849-883. 2017.