Efficient evaluation of Bézier-type objects and their derivatives

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A linear-time algorithm for computing a point on a polynomial or rational curve in Bézier form with good geometric and numerical properties has been recently given in [2]. This approach has also found applications in accelerating the evaluation of Bézier surfaces and even B-spline curves (for details, see [1]). We show that the method proposed in [2] can be generalized to efficiently compute the quantities $R'_n(t), R''_n(t), \ldots, R^{(k)}_n(t)$, where R_n is a d-dimensional rational Bézier curve of degree n and $t \in [0, 1]$. Moreover, the algorithm may be adapted for a more general family of rational parametric objects. Some remarks are given about applying it to Bézier surfaces.

Joint work with: Paweł Woźny (Institute of Computer Science, University of Wrocław, Poland)

References

[1] F. Chudy, *New algorithms for Bernstein polynomials, their dual bases and B-spline functions*, Ph.D. Thesis, University of Wrocław, 2022 (available on request).

[2] P. Woźny and F. Chudy, Linear-time geometric algorithm for evaluating Bézier curves, *Computer Aided-Design* 118 (2020), 102760.