

PARTITIONS OF UNITY AND BARYCENTRIC ALGEBRAS

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Barycentric coordinates provide solutions to the problem of expressing an element of a compact convex set as a convex combination of a finite number of extreme points of the set. A barycentric coordinate system is usually characterized by two properties: the “partition of unity” property (understood as a partition of the constant function $\mathbb{1}_\Pi$ where the output value is 1) and the “linear precision” property (a partition of the identity function 1_Π on Π). Barycentric coordinates have been studied widely within the geometric literature, typically in response to the demands of interpolation, numerical analysis and computer graphics.

In [1, 2] the authors brought an algebraic perspective to the problem. They developed a general framework for the study of barycentric coordinate systems on a given convex polytope, founded on the theory of *barycentric algebras* introduced in the nineteen-fifties independently by M.H. Stone and H. Kneser for the axiomatization of real convex sets.

In this talk we focus on the discussion of relations between different subclasses of partitions of unity giving them an algebraic interpretation [3].

References

- [1] A.B. Romanowska, J.D.H. Smith, A. Zamojska-Dzienio, *Barycentric algebra and convex polygon coordinates*, submitted. Available at <https://arxiv.org/abs/2308.11634>
- [2] A.B. Romanowska, J.D.H. Smith, A. Zamojska-Dzienio, *From affine to barycentric coordinates in polytopes*, Banach Center Publications **129** (2025), 185–200.
- [3] A. Zamojska-Dzienio, *Partitions of unity and barycentric algebras*, to appear in: Workshop on Geometric Methods in Physics (Trends in Mathematics, Springer) (2025)