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On the Max-Product Generalized Multinode Shepard Operators

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Abstract

Recent literature in approximation theory has successfully enhanced classical Shepard operators by embedding non-linear max-product operations, notably through combinations with various polynomial (such as Bernoulli polynomials or multivariable Taylor expansions, among others).

However, these existing frameworks remain fundamentally restricted to classical single-node topologies. To overcome these limitations and provide a purely geometric alternative, this work introduces a novel non-linear max-product operator built upon a generalized multinode Shepard framework.

Our approach clusters scattered data into flexible τ-node subsets to construct high-order local polynomial interpolants using only functional values. By applying the non-linear max-product technique over these multinode bases, the proposed operator enhances the approximation order, effectively preserves the intrinsic shape of the target function, and eliminates spurious oscillations. Theoretical error estimates are established, and numerical experiments confirm the operator's accuracy and robustness in scattered data interpolation.

Keywords: Integral equations, meshless methods, collocation method, multinode Shepard method.

References:

[1] T. Y. Gökçer Ellidokuz, Approximation with max-product Shepard-Bernoulli operators. J. Comput. Appl. Math. 482 (2026), Paper No. 117313, 13 pp.

[2] O. Duman, Max-product Shepard operators based on multivariable Taylor polynomials. J. Comput. Appl. Math. 437 (2024), Paper No. 115456, 15 pp.

[3] D. Barrera, O. Nouisser and B. Zerroudi, A Shepard-like Hermite interpolation operator with fourth approximation order. J. Comput. Appl. Math. 477 (2026), Paper No. 117158, 15 pp.

[4] F. Dell'Accio, F. Di Tommaso, O. Nouisser and B. Zerroudi, Fast and accurate scattered Hermite interpolation by triangular Shepard operators. J. Comput. Appl. Math. 382 (2021), Paper No. 113092, 15 pp.

[5] F. Di Tommaso and F. Dell'Accio, Rate of convergence of multinode Shepard operators, Dolomites Res. Notes Approx. 12 (2019), no. 1, 1–6.