

XY-CONVEX FREE POLYNOMIALS REVISITED

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Abstract. In this article, by using the matrix-valued analog of a factorization property of free polynomials, we offer an alternate approach to the structure of matrix-valued hermitian free polynomials that are xy -convex.

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REFERENCES

- [1] S. BALASUBRAMANIAN, N. HOTWANI AND S. MCCULLOUGH, *Bilinear matrix inequalities and polynomials in several freely noncommuting variables*, J. Math. Anal. Appl. **526** (1), p. 127196, 2023.
- [2] H. DYM, J. W. HELTON AND S. MCCULLOUGH, *Irreducible non-commutative defining polynomials for convex sets have degree four or less*, Indiana Univ. Math. J. **56** (2007), 1189–1232.
- [3] H. DYM, J. W. HELTON AND S. MCCULLOUGH, *The Hessian of a non-commutative polynomial has numerous negative eigenvalues*, Journal D'Analyse Mathématique **102** (2007), 29–76.
- [4] H. DYM, J. W. HELTON AND S. MCCULLOUGH, *NC polys with convex level slices*, Indiana University Mathematics Journal, vol. 66, no. 6 (2017), pp. 2071–2135.
- [5] D. M. HAY, J. W. HELTON, A. LIM AND S. MCCULLOUGH, *Non commutative Partial Matrix Convexity*, Indiana University Mathematics Journal, vol. 57, no. 6 (2008): 2815–42.
- [6] J. W. HELTON AND S. MCCULLOUGH, *Convex non-commutative polynomials have degree two or less*, SIAM J. Matrix Anal. Appl. **25** (2004), 1124–1139.
- [7] MICHAEL JURY, IGOR KLEP, MARK E. MANCUSO, SCOTT MCCULLOUGH, JAMES ELDRED PASCOE, *Noncommutative partially convex rational functions*, Rev. Mat. Iberoam. **38** (2022), no. 3, pp. 731–759.
- [8] MICHAEL JURY, IGOR KLEP, MARK E. MANCUSO, SCOTT MCCULLOUGH, JAMES ELDRED PASCOE, *Noncommutative partially convex rational functions*, <https://arxiv.org/pdf/2005.01086>.
- [9] M. JURY, I. KLEP, M. E. MANCUSO, S. MCCULLOUGH, J. PASCOE, *Noncommutative Partial Convexity Via Γ -Convexity*, J. Geom. Anal. **31**, 3137–3160 (2021).
- [10] J. E. PASCOE, RYAN TULLY-DOYLE, *The royal road to automatic noncommutative real analyticity, monotonicity, and convexity*, [arXiv:1907.05875](https://arxiv.org/abs/1907.05875).
- [11] V. PAULSEN, *Completely bounded maps and operator algebras*, Cambridge University Press, 2003.