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Abstract

Construction of Symmetric Determinantal Representations of Hyperbolic Forms †

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Let A be an n-by-n matrix. The determinantal ternary form associated to A, defined by F(t,x,y;A) = det(tI + xH + yK), is hyperbolic with respect to (1,0,0), where H = (A + A*)/2 and K = (A − A*)/(2i). Kippenhahn (1951) characterized the numerical range of a matrix A as the convex hull of the real affine part of the dual curve of the curve F(t,x,y;A) = 0. The Fiedler–Lax conjecture has recently been proved by Helton and Vinnikov (2007) which confirms that every hyperbolic ternary form admits a symmetric determinantal representation. In other words, for any real hyperbolic ternary form F(t,x,y), there exist real symmetric matrices H and K such that F(t,x,y) = F(t,x,y;H + iK). We construct real symmetric matrices for the determinantal representations of some hyperbolic ternary forms and the orbits of a point mass under central forces.

Conflicts of Interest: The authors declare no conflict of interest.

References

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