Chebyshev-like polynomials satisfying fourth-order linear recurrences: Zeros and Hankel determinants

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We study sequences of polynomials that satisfy certain fourth-order linear recurrences with a parameter c. We show that for c real, their zeros lie on two concentric and inversely related circles. The associated $n \times n$ Hankel determinants are determined. Here, the 2×2 case is the most challenging, and has an intriguing connection with questions concerning sets of polynomials with all roots on the unit circle. These polynomials arise from Chebyshevian modifications of finite geometric series.
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