

## ON THE NORMS OF GEOMETRIC CIRCULANT MATRICES WITH THE QUADRAPELL NUMBERS

ALEKSANDRA ERIĆ AND IVAN LAZAREVIĆ\*

**Abstract.** In this paper we give the some bounds of the spectral norm for  $r$ -geometric circulant matrices with the Quadrapell numbers. In addition, there are some remarks on Quadrapell numbers and a proof of the conjecture about  $\lim_{n \rightarrow \infty} \frac{D_{n+1}}{D_n}$  stated by D. Tasci.

**Mathematics subject classification (2020):** 15A60, 15B99, 11B39.

**Keywords and phrases:** Quadrapell numbers, geometric circulant matrix, spectral norms.

### REFERENCES

- [1] M. BAHSI, *On the norms of circulant matrices with generalized Fibonacci and Lucas numbers*, TWWS Journal of Pure and Applied Mathematics **6**: (1), 84–92, (2015).
- [2] R. A. HORN AND C. R. JOHNSON, *Topics in matrix analysis*, Cambridge University Press, 1994.
- [3] J. LI, Z. JIANG, F. LU, *Determinantes, norms and spread of circulant matrices with Tribonacci generalized Lucas numbers*, Abstract Applied Analysis (2016).
- [4] D. KALMAN AND M. ROBERT, *The Fibonacci numbers-exposed*, Mathematics Magazine **76.3** (2003): 167–181.
- [5] C. KIZILATEŞ AND N. TUĞLU, *On the norms of geometric and symmetric geometric circulant matrices with the Tribonacci number*, Gazi University Journal of Science **31.2** (2018): 555–567.
- [6] C. KIZILATEŞ, T. NAIM, *On the bounds for the spectral norms of geometric circulant matrices*, Journal of Inequalities and Application **2016**: 312 (2016).
- [7] T. KOSHY, *Fibonacci and Lucas Numbers with Applications*, vol. 2, John Wiley and Sons, 2019.
- [8] C. H. SHEN, J. M. CEN, *On the bounds for the norms of  $r$ -circulant matrices with Fibonacci and Lucas numbers*, Applied Mathematics and Computation **216**: 2891–2897, (2010).
- [9] S. SOLAK, *On the norms of circulant matrices with the Fibonacci and Lucas numbers*, Applied Mathematics and Computation **160**: 125–132, (2005).
- [10] D. TASCI, *On quadrapell numbers and quadrapell polynomials*, Hacettepe Journal of Mathematics and Statistics **38.3** (2009): 265–275.
- [11] D. ZEILIN, *On Summation Formulas and Identities for Fibonacci Numbers*, The Fibonacci Quarterly **5.1**, 1–43, (1967).