

Invertibility of some special matrices involving certain numbers

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Abstract. A family of structured matrices, such as Toeplitz, Hankel, Vandermonde, circulant, Hessenberg, Cauchy, and other well-known families of special matrices, offering extensive utility in digital signal processing, image manipulation, coding theory, statistics, quantum mechanics, and more. A particularly intriguing scenario arises when their elements are derived from k -Horadam numbers or Chebyshev polynomials, encompassing Fibonacci, Lucas, and Pell numbers. Additionally, the case where matrix entries are composed of generalized Narayana numbers is also of interest. We will present the conditions under which circulant and skew circulant matrices involving generalized Narayana numbers are invertible. These findings not only have practical applications across various fields but also contribute to advancing our comprehension of structured matrices and their inherent characteristics.

Keywords: circulant matrices; skew circulant matrices; invertibility; generalized Narayana numbers.

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