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AN APPLICATION OF HYPERHARMONIC NUMBERS IN MATRICES

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Abstract

In this study, firstly we defined an $n \times k$ matrix, $G_{n,k}^{(r)}$, whose entries consist of hyperharmonic numbers. Then we obtained relation between Pascal matrices and $G_{n,k}^{r}$. Finally we calculated the determinant of $G_{n,n}^{r}$.

Keywords: Pascal Matrix; Hyperharmonic numbers; Determinant

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1. Introduction

For $n > 0$ and $1 \leq i \leq k$, let define the order-k sequences be as following:

$$g_n^i = \sum_{j=1}^{k} c_j g_{n-j}^i \tag{1.1}$$

with initial values $g_{1-k}^i, g_{2-k}^i, \ldots, g_0^i$, where c_j $(1 \leq j \leq k)$ are constant coefficients, g_n^i is the nth term of ith sequence. Let the $k \times k$ matrix be as following:

$$G_n = \begin{bmatrix} g_n^1 & g_n^2 & \cdots & g_n^k \\ g_{n-1}^1 & g_{n-1}^2 & \cdots & g_{n-1}^k \\ \vdots & \vdots & & \vdots \\ g_{n-k+1}^1 & g_{n-k+1}^2 & \cdots & g_{n-k+1}^k \end{bmatrix} \tag{1.2}$$

There have been many papers related to the sequences as in (1.1) [1, 2, 3, 4, 5]. In [1], Kalman obtained a number of closed-form formulas for the generalized sequence by matrix method.

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