

Preface

The thesis entitled "Certain generalized matrix functions and their properties" contains the research work carried out by me under the able guidance of Dr. B. I. Dave, Professor, Department of Mathematics, Faculty of Science, The Maharaja Sayajirao University of Baroda, Vadodara - 390002.

The contents of the thesis is to propose a matrix analogue of a polynomial of general nature and derive its inverse series relation, generating functions, summation formulas etc. There are total six chapters in the thesis.

Chapter-1 is briefing about the hypergeometric functions, some useful formulas in Pochhammer symbol, inverse pairs involving certain polynomials and Riordan's inverse pairs. Followed by this, the matrix polynomial, Pochhammer symbol of a matrix, Gamma matrix function, Beta matrix function, hypergeometric matrix function etc. are main contents.

In chapter-2, a general class of matrix polynomials is proposed which encompasses the matrix forms of extended Jacobi polynomial, Wilson polynomial and Racah polynomial. The inverse series relation, generating function relations, summation formulas are derived for this general class. Some of the Riordan's classes are emerging as special cases; they are tabulated at last.

Chapter-3 incorporates an inversion pair of matrix series involving finite as well as infinite series. As an instance of finite inverse series, the generalized Humbert polynomial occurs with its inverse matrix series. Thereby the polynomials of Humbert, Pincherle, Kinney, Gegenbauer etc. admit matrix forms along with their inverse matrix series representations. Here also, the Wilson polynomial and Racah polynomial arise in their matrix extension forms. Interestingly, almost all the classes of inverse series relations due to John Riordan assume the matrix extensions. They are tabulated at the end.

A few generalization of the Konhauser polynomial are occurring in the literature hitherto on polynomials.

In chapter-4, one such generalization is extended to matrix form and its differential equation, inverse series, generating functions relations, summation formulas, mixed relation and Beta matrix transform are obtained. A generalization of the Mittag-Leffler function is provided matrix extension in chapter-5. For this function, the differential equation, Eigen function property and Mixed relation are derived. Observing that this function gives rise to another generalization of Konhauser matrix polynomial, the properties like inverse series relation, generating function relation, summation formulas are derived.

Chapter-6, the last one, introduces the matrix analogue of a generalization of M-series and some other special functions. A number of contiguous function relations are derived, and the differential equation, matrix differential formulas, integral representation, fractional integral and derivative forms are derived.

A shortened version of the contents of the chapters may be found in the following published papers.

1. **Reshma Sanjhira** and B. I. Dave, Generalized Konhauser matrix polynomial and its properties, The Mathematics Student, 87 No. 3-4, (2018), 109-120.
(MR# 3839402, UGC-CARE list)
2. **Reshma Sanjhira**, B. V. Nathwani and B. I. Dave, Generalized Mittag-Liffler matrix function and associated matrix polynomials, The Journal of the Indian Math. Soc. 86, No. 1-2, (2019), 161-178.
(MR#3893796, UGC-CARE list, Scopus, SJR-0.19)
3. **Reshma Sanjhira**, A General Matrix Inverse Series Relation and Associated Polynomials -II, Mathematica Slovaca 71, No.2, (2021), 301-316.
(MR#4243628, Web of Sciences,UGC-CARE list, Scopus, Impact Factor-0.64)
4. Ravi Dwivedi and **Reshma Sanjhira**, On the matrix function ${}_pR_q(A, B; z)$ and its fractional calculus properties, Communication in Mathematics, (Accepted).
(UGC-CARE list, Scopus)

The following paper is communicated.

1. **Reshma Sanjhira** and B. I. Dave, A general matrix series inversion pair and associated polynomials(communicated).

The following are the papers presented in National International conferences.

1. Presented the paper entitled "Generalized Konhauser matrix polynomial and its properties" at the International Conference on Special Functions & Applications (ICSFA 2017) held at College of Engineering & Technology, Bikaner (Rajasthan), India during 2-4 November, 2017.
2. Presented the paper entitled " A general matrix inverse series relation and associated polynomials" at the International Conference on Mathematical Modeling, Applied Analysis and Computation (ICMMAAC-2018) held at Department of Mathematics and Statistics , JECRC University, Jaipur, India, from 06-08 July, 2018.
3. Presented the paper entitled "A matrix analogue of a general inversion pair and associated matrix polynomials" at International Conference on Mathematical Analysis And Application (MAA-2020) held at the department of Mathematics, National Institute of Technology (NIT), Jamshedpur, India, from 02-04 November, 2020.

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(Reshma Rohitkumar Sanjhira)