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On Certain Transformations of Bivariate Basic Hypergeometric Series using q-Fractional Operators

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Abstract: The object of this paper is to derive a transformation expressing a bivariate basic hypergeometric function in terms of a finite sum of basic hypergeometric function by the application of q-fractional derivatives using some known results.

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1. Introduction

For real or complex a, $q < 1$, the q -shifted factorial is defined by

$$(a,q)_n = \begin{cases} 0 & \text{if } n = 0; \\ (1-a)(1-aq)(1-aq^2)\ldots,(1-aq^{n-1}) & \text{if } n \in N. \end{cases} \tag{1.1}$$

The generalized basic hypergeometric series (cf. Gasper and Rahman[2]) is defined by

$${}_r\phi_s\left[\begin{array}{l} a_1, a_2, \ldots, a_r \\ \qquad\qquad\qquad ; q, z \\ b_1, b_2, \ldots, b_s \end{array}\right] = \sum_{n=0}^{\infty} \frac{(a_1, a_2, \ldots, a_r)_n}{(q, b_1, b_2, \ldots, b_s)_n}[(-1)^n q^{n(n-1)/2}]^{1+s-r} z^n, \tag{1.2}$$

where r and s are positive integers, $q \neq 0$ when $r > s+1$, the numerator parameters $a_1; \ldots; a_r$ and the denominator parameters $b_1; \ldots; b_s$ being complex quantities provided that $b_j \neq q^{-m}; m = 0; 1; \ldots; j = 1; 2; \ldots; s$: If $0 < |q| < 1$, the above series converges absolutely for all x if $r \leq s$ and for $|x| < 1$ if $r = s+1$. This series also converges absolutely if $|q| > 1$ and $|z| < |b_1 b_2 \ldots b_s|/|a_1 a_2 \ldots a_r|$
The abnormal type of generalized basic hypergeometric series ${}_r\phi_s(.)$ is defined as

$${}_r\phi_s\left[\begin{array}{l} a_1, a_2, \ldots, a_r; q, z \\ b_1, b_2, \ldots, b_s; q^{\lambda} \end{array}\right] = \sum_{n=0}^{\infty} \frac{(a_1, a_2, \ldots, a_r; q)_n}{(b_1, b_2, \ldots, b_s; q)_n} z^n q^{\lambda n(n+1)/2}, \tag{1.3}$$