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On continued fraction representations of certain function of hypergeometric type

Syed Siddique Mustafa Rizvi,
Department of Mathematics,
Dr. M. C. Saxena College of Engineering
and Technology, Lucknow (U.P.) India

Abstract: In the present work we have established a number of continued fraction representations for the function $F(a, b, c, d, t)$. Our results produce certain new and many known results in the literature as their special cases.
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1. Introduction, Notations and Definitions

Let, for $|q| < 1$

$$(a;q)_n = (1-a)(1-aq)...(1-aq^{n-1}) \qquad \& \quad (a;q)_0 = 1$$

Then ${}_3\Phi_2[a;b,c,d;t]$ series has been defined as,

$${}_3\Phi_2[a;b,c,d;t] = \sum_{n=0}^{\infty} \frac{(a)_n(b)_n}{(c)_n(d)_n} t^n$$

The function $F(a, b, c, d, t)$ has been extensively studied. It is easy to see that $F(a, b, c, d, t)$ satisfies the following relations.

$$F(a,b,c,d;t) = 1 + \frac{(1-a)(1-b)}{(1-c)(1-d)} tF(aq,bq,cq,dq;t) \tag{1.1}$$

$$\begin{aligned} q^2(1-t)F(a,b,c,d;t) + [(a+b)tq^2 - (c+d)q]F(a,b,c,d;tq) \\ +(cd - abtq^2)F(a,b,c,d;tq^2) = cd - (c+d-q)q \end{aligned} \tag{1.2}$$

$$\begin{aligned} &(1-c)(1-d)(1-t)F(a,b,c,d;t) \\ &= (1-c)(1-d) + (c+d-a-b)tF(a,b,cq,dq;tq) \\ &\quad +(ab-cd)tF(a,b,cq,dq,tq^2) \end{aligned} \tag{1.3}$$