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q-ANALOGUE OF HILFER-KATUGAMPOLA FRACTIONAL DERIVATIVES AND APPLICATIONS

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Abstract: A novel q^p-variant of the $q-$Mittag-Leffler function and a quantum analogue ${}^p\mathcal{D}^{\alpha,\beta}_{a\pm,q}$ of the Hilfer-Katugampola fractional derivative are defined. Then, generalizations of the $q-$Taylor's formula and the $q-$differential transform and its inverse are obtained using the operator ${}^p\mathcal{D}^{\alpha,\beta}_{a\pm,q}$. Additionally, a few properties of the newly defined q-differential transform are established. Finally, three proposed fractional q-difference equations are solved to show the effectiveness of the transform.

Keywords and Phrases: Hilfer-Katugampola fractional q-derivatives, q^p-Mittag-Leffler function, Generalized q-Taylor's formula, Generalized q-differential transform method.

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1. Introduction

The theory of fractional q-difference calculus, which generalizes the concept of q-derivatives and q-integrals up to non-integer orders, emerged from the work of Al-Salam [3], Agarwal [2], Rajkovic *et al.* [26]. They presented a number of q-variants