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An Application of the Double Elzaki Transform in Partial Differential Equations

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Abstract: *The partial differential equation plays an important role in Physics, Chemistry, Differential Equations and many more applied subjects. Also various methods of solving partial differential equations are found in literature. In this paper, we use double Elzaki Transform to solve some partial Differential equations.*

Keywords: Elzaki Transform, Double Elzaki Transform, Function of exponential order, Partial Differential Equation

I. Introduction

In Science and Engineering issues, we generally look for answer of the various differential equations with initial and boundary conditions. On account of conventional differential conditions, we may initially observe the overall arrangement and decide the constants from conditions. But similar method is not working for partial differential equations. So it is challenging to change these constant and capacities to fulfil the given limit and conditions.The Boundary value problems, Initial value problems, Heat equations, Wave equations are mathematically represented in terms of partial differential equation. The partial differential equations are solved by various ways: i) by using method of separation, ii) by using integral Transforms, iii) by using Numerical methods, iv) Decomposition methods, etc. In literature various articles are found with this reference, [14] explains solution of partial differential equation by using numerical methods, [2] explains convolution method, [3], [7], [8], [9], [12], [15] presents integral Transform method. In method of integral transform involves Fourier Transform, Laplace Transform, Double Sumudu transform and Double Laplace Transform. In this paper we use Double Elzaki Transform to solving some partial differential equations. We use the following definitions and properties for further calculations.

II. Definitions And Properties

2.1 Definitions:

Double Elzaki Transform

Let $f(x,y)$with $x,y>0$ be a function which can be expressed as a convergent infinite series then its Double Elzaki Transform is defined as,

$$E_2\{f(x,y);u,v\} = T(u,v) = uv\int_0^\infty \int_0^\infty f(x,y)e^{-\left(\frac{x}{u}+\frac{y}{v}\right)}dxdy,$$

whenever integral exist.

Inverse double Elzaki Transform is defined as,

$$E_2^{-1}\{T(u,v)\} = f(x,y),\ x,y>0.$$

Function of exponential order:

The function $f(x,y)$ is said to be of exponential order,

$a>0, b>0$ on $0\le x<\infty$,

$0\le y<\infty$

if there exists a positive constants k such that,

$$|f(x,y)| \le ke^{\frac{x}{a}+\frac{y}{b}}.$$