

## Analytical Solution for Telegraph Equation by Modified of Sumudu Transform "Elzaki Transform"

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### Abstract

In this work modified of Sumudu transform [10,11,12] which is called Elzaki transform method ( new integral transform) is considered to solve general linear telegraph equation, this method is a powerful tool for solving differential equations and integral equations [1, 2, 3, 4, 5]. Using modified of Sumudu transform or Elzaki transform, it is possible to find the exact solution of telegraph equation. This method is more efficient and easier to handle as compare to the Sumudu transform method and variational iteration method. To illustrate the ability of the method some examples are provided.

**Keywords:** modified of Sumudu transform- Elzaki transform - Telegraph equation - Partial Derivatives

### 1. Introduction

Telegraph equations appear in the propagation of electrical signals along a telegraph line, digital image processing, telecommunication, signals and systems.

The general linear telegraph equation is

$$U_{xx} + aU_x + bU = c^2U_{tt} \quad (1)$$

With the initial conditions:

$$U(x, 0) = \alpha \quad , \quad U_x(x, 0) = \beta \quad (2)$$

Where  $\alpha, \beta$  are functions of  $x$ .

The basic definitions of modified of Sumudu transform or Elzaki transform is defined as follows [1, 2].

Elzaki transform of the function  $f(t)$  is

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