Performance Evaluation of Mohand and Elzaki Transform Techniques in Applied Mathematics

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ABSTRACT
Many advanced problems, which appear in the field of engineering and sciences like heat conduction problems, mechanical oscillation problems, vibrating beams problems, electric circuit problems, population growth and radioactive decay problems, can be solved by integral transforms. In this paper, we present a comparative study of two integral transforms namely Mohand and Elzaki transforms and solve some systems of differential equations (Homogeneous & Non-Homogeneous) using both the transforms in application section. Results show that Mohand and Elzaki transforms are closely connected.

Keywords: *Mohand transform, Elzaki transform, System of differential equations.*

I. INTRODUCTION

The advanced problems of mathematics, physics, chemistry, social science, biology, radio physics, astronomy, nuclear science, electronics, chemical and mechanical engineering can be solved using integral transforms (Laplace transform [1, 7-11], Fourier transform [1], Aboodh transform [2], Hankel transform [1], Z-transform [1, 11], Wavelet transform [1], Elzaki transform [4], Mahgoub transform [5], Mohand transform [6], Sumudu transform [12], Mellin transform [1], Hermite transform [1], Kamal transform [3], etc.). Many real world problems, which are mathematically represented by differential equations, delay differential equations, partial differential equations, partial integro-differential equations, integral equations, integro-differential equations, solved by many scholars [13-28] using these transforms.

Aggarwal et al. [29] solved the problems of population growth and decay by applying Mohand transform. Aggarwal et al. [30] gave Mohand transform of Bessel's functions. Kumar et al. [31] applied Mohand transform and solved first kind linear Volterra integral equations. Kumar et al. [32] applied Mohand transform for solving the mechanics and electrical circuit problems. Aggarwal et al. [33] gave the solution of second kind linear Volterra integral equations using Mohand transform. Sathya and Rajeswari [34] used Mohand transform and solved linear partial integro-differential equations. The solution of linear Volterra integro-differential equations usaing Mohand transform was given by Kumar et al. [35].

Elzaki and Ezaki [36] used Elzaki transform and solved ordinary differential equation with variable coefficients. Elzaki and Ezaki [37] used Elzaki transform for solving partial differential equations. Shendkar and Jadhav [38] applied Elzaki transform for solving differential equations. Aggarwal et al. [39] used Elzaki transform for solving population growth and decay problems. Aggarwal et al. [40] applied Elzaki transform for solving linear Volterra integral equations of first kind. Aggarwal [41] defined Elzaki transform of Bessel's functions. A comparative study of Mohand and Laplace transforms was given by Aggarwal and Chaudhary [42].

In this paper, we concentrate mainly on the comparative study of Mohand and Elzaki transforms and we solve some systems of differential equations using these transforms.

II. DEFINITION OF MOHAND AND ELZAKI TRANSFORMS

2.1 Definition of Mohand transforms:

Mohand and Mahgoub [6] defined "Mohand transform'' of the function $F(t)$ for $t \geq 0$ as

$$M\{F(t)\} = v^2 \int_0^\infty F(t)e^{-vt}dt = R(v), 0 < k_1 \leq v \leq k_2,$$

where the operator M is called the Mohand transform operator.

2.2 Definition of Elzaki transforms:

Elzaki [4] defined a new integral transform "Elzaki transform'' of the function $F(t)$ for $t \geq 0$ as

$E\{F(t)\} = v\int_0^\infty F(t)e^{\frac{-t}{v}}dt = T(v),\ 0 < k_1 \leq v \leq k_2,$

where the operator E is called the Elzaki transform operator.

If $F(t)$ is piecewise continuous and of exponential order then Mohand and Elzaki transforms of the function $F(t)$ for $t \geq 0$ exist. These two conditions are sufficient conditions for the existence of Mohand and Elzaki transforms of the function $F(t)$.

III. PROPERTIES OF MOHAND AND ELZAKI TRANSFORMS

In this section, we present some useful properties of Mohand and Elzaki transforms like the linearity property, change of scale property, first shifting theorem and convolution theorem.

3.1 Linearity property of Mohand and Elzaki transforms:

a. **Linearity property of Mohand transforms [29-30, 33]:** If Mohand transform of functions $F_1(t)$ and $F_2(t)$ are $R_1(v)$ and $R_2(v)$ respectively then Mohand transform of $[aF_1(t) + bF_2(t)]$ is given by $[aR_1(v) + bR_2(v)]$, where a, b are arbitrary constants.
b. **Linearity property of Elzaki transforms [39-41]:** If Elzaki transform of functions $F_1(t)$ and $F_2(t)$ are $T_1(v)$ and $T_2(v)$ respectively then Elzaki transform of $[aF_1(t) + bF_2(t)]$ is given by $[a\,T_1(v) + bT_2(v)]$, where a, b are arbitrary constants.

3.2 Change of scale property of Mohand and Elzaki transforms:

a. **Change of scale property of Mohand transforms [30, 33]:** If Mohand transform of function $F(t)$ is $R(v)$ then Mohand transform of function $F(at)$ is given by $aR\left(\frac{v}{a}\right)$.
b. **Change of scale property of Elzaki transforms [41]:** If Elzaki transform of function $F(t)$ is $T(v)$ then Elzaki transform of function $F(at)$ is given by $\frac{1}{a^2}T(av)$.

3.3 Shifting property of Mohand and Elzaki transforms:

a. **Shifting property of Mohand transforms [33]:** If Mohand transform of function $F(t)$ is $R(v)$ then Mohand transform of function $e^{at}F(t)$ is given by $\frac{v^2}{(v-a)^2}R(v-a)$.
b. **Shifting property of Elzaki transforms:** If Elzaki transform of function $F(t)$ is $T(v)$ then Elzaki transform of function $e^{at}F(t)$ is given by $(1-av)T\left(\frac{v}{(1-av)}\right)$.

Proof: By the definition of Elzaki transform, we have

$$E\{e^{at}F(t)\} = v\int_0^\infty e^{at}F(t)e^{\frac{-t}{v}}dt = v\int_0^\infty F(t)e^{-\left[\frac{1}{v}-a\right]t}dt$$

$$= v\int_0^\infty F(t)e^{-\frac{t}{\left[{v}/{(1-av)}\right]}}dt = (1-av)\left[\frac{v}{(1-av)}\int_0^\infty F(t)e^{-\frac{t}{\left[{v}/{(1-av)}\right]}}dt\right] = (1-av)T\left(\frac{v}{1-av}\right).$$

3.4 Convolution theorem for Mohand and Elzaki transforms:

a. **Convolution theorem for Mohand transforms [31, 33, 35]:** If Mohand transform of functions $F_1(t)$ and $F_2(t)$ are $R_1(v)$ and $R_2(v)$ respectively then Mohand transform of their convolution $F_1(t) * F_2(t)$ is given by

$$M\{F_1(t) * F_2(t)\} = \frac{1}{v^2}M\{F_1(t)\}M\{F_2(t)\}$$

$\Rightarrow M\{F_1(t) * F_2(t)\} = \frac{1}{v^2}R_1(v)R_2(v)$, where $F_1(t) * F_2(t)$ is defined by

$$F_1(t) * F_2(t) = \int_0^t F_1(t-x)\,F_2(x)dx = \int_0^t F_1(x)\,F_2(t-x)dx$$

b. **Convolution theorem for Elzaki transforms [40-41]:** If Elzaki transform of functions $F_1(t)$ and $F_2(t)$ are $T_1(v)$ and $T_2(v)$ respectively then Elzaki transform of their convolution $F_1(t) * F_2(t)$ is given by

$$E\{F_1(t) * F_2(t)\} = \frac{1}{v}E\{F_1(t)\}E\{F_2(t)\}$$

$\Rightarrow E\{F_1(t) * F_2(t)\} = \frac{1}{v} T_1(v)\, T_2(v)$, where $F_1(t) * F_2(t)$ is defined by

$F_1(t) * F_2(t) = \int_0^t F_1(t-x)\, F_2(x) dx = \int_0^t F_1(x)\, F_2(t-x) dx$

IV. MOHAND AND ELZAKI TRANSFORMS OF THE DERIVATIVES OF THE FUNCTION $F(t)$

4.1 Mohand transforms of the derivatives of the function $F(t)$ [29-30]:

If $M\{F(t)\} = R(v)$ then

a) $M\{F'(t)\} = vR(v) - v^2 F(0)$
b) $M\{F''(t)\} = v^2 R(v) - v^3 F(0) - v^2 F'(0)$
c) $M\{F^{(n)}(t)\} = v^n R(v) - v^{n+1} F(0) - v^n F'(0) - \cdots \ldots - v^2 F^{(n-1)}(0)$

4.2 Elzaki transforms of the derivatives of the function $F(t)$ [39, 41]:

If $E\{F(t)\} = T(v)$then

a) $E\{F'(t)\} = \frac{1}{v} T(v) - vF(0)$
b) $E\{F''(t)\} = \frac{1}{v^2} T(v) - F(0) - vF'(0)$
c) $E\{F^{(n)}(t)\} = \frac{1}{v^n} T(v) - \frac{1}{v^{n-2}} F(0) - \frac{1}{v^{n-3}} F'(0) \ldots \ldots - vF^{(n-1)}(0)$

V. MOHAND AND ELZAKI TRANSFORMS OF FREQUENTLY USED FUNCTIONS [29-33, 39-41]

Table: 1

S.N.	$F(t)$	$M\{F(t)\} = R(v)$	$E\{F(t)\} = T(v)$
1.	1	v	v^2
2.	t	1	v^3
3.	t^2	$\frac{2!}{v}$	$2!\, v^4$
4.	$t^n, n \in N$	$\frac{n!}{v^{n-1}}$	$n!\, v^{n+2}$
5.	$t^n, n > -1$	$\frac{\Gamma(n+1)}{v^{n-1}}$	$\Gamma(n+1) v^{n+2}$
6.	e^{at}	$\frac{v^2}{v-a}$	$\frac{v^2}{1-av}$
7.	$sinat$	$\frac{av^2}{(v^2+a^2)}$	$\frac{av^3}{1+a^2v^2}$
8.	$cosat$	$\frac{v^3}{(v^2+a^2)}$	$\frac{v^2}{1+a^2v^2}$
9.	$sinhat$	$\frac{av^2}{(v^2-a^2)}$	$\frac{av^3}{1-a^2v^2}$
10.	$coshat$	$\frac{v^3}{(v^2-a^2)}$	$\frac{v^2}{1-a^2v^2}$

VI. INVERSE MOHAND AND ELZAKI TRANSFORMS

6.1 Inverse Mohand transforms [29, 33, 42]: If $R(v)$is the Mohand transform of $F(t)$then $F(t)$is called the inverse Mohand transform of $R(v)$and in mathematical terms, it can be expressed as

$F(t) = M^{-1}\{R(v)\}$, where M^{-1} is an operator and it is called as inverse Mohand transform operator.

6.2 Inverse Elzaki transforms [39-41]: If $T(v)$ is the Elzaki transforms of $F(t)$then $F(t)$ is called the inverse Elzaki transform of $T(v)$and in mathematical terms, it can be expressed as
$F(t) = E^{-1}\{T(v)\}$, where E^{-1} is an operator and it is called as inverse Elzaki transform operator.

VII. INVERSE MOHAND AND ELZAKI TRANSFORMS OF FREQUENTLY USED FUNCTIONS [29, 39-41]

Table: 2

S.N.	$R(v)$	$F(t) = M^{-1}\{R(v)\} = E^{-1}\{T(v)\}$	$T(v)$
1.	v	1	v^2
2.	1	t	v^3
3.	$\frac{1}{v}$	$\frac{t^2}{2}$	v^4
4.	$\frac{1}{v^{n-1}}$	$\frac{t^n}{n!}, n \in N$	v^{n+2}
5.	$\frac{1}{v^{n-1}}$	$\frac{t^n}{\Gamma(n+1)}, n > -1$	v^{n+2}
6.	$\frac{v^2}{v-a}$	e^{at}	$\frac{v^2}{1-av}$
7.	$\frac{v^2}{(v^2+a^2)}$	$\frac{sinat}{a}$	$\frac{v^3}{1+a^2v^2}$
8.	$\frac{v^3}{(v^2+a^2)}$	$cosat$	$\frac{v^2}{1+a^2v^2}$
9.	$\frac{v^2}{(v^2-a^2)}$	$\frac{sinhat}{a}$	$\frac{v^3}{1-a^2v^2}$
10.	$\frac{v^3}{(v^2-a^2)}$	$coshat$	$\frac{v^2}{1-a^2v^2}$

VIII. APPLICATIONS OF MOHAND AND ELZAKI TRANSFORMS FOR SOLVING SYSTEM OF DIFFERENTIAL EQUATIONS

In this section some numerical applications are given to explain the procedure of solving the systems of differential equations (Homogeneous & Non-Homogeneous) using Mohand and Elzaki transforms.

8.1 Consider a system of linear ordinary differential equations

$$\left.\begin{aligned} \frac{d^2x}{dt^2} + 3x - 2y = 0 \\ \frac{d^2x}{dt^2} + \frac{d^2y}{dt^2} - 3x + 5y = 0 \end{aligned}\right\} \quad (1)$$

with $x(0) = 0, y(0) = 0, x'(0) = 3, y'(0) = 2$ (2)

Solution using Mohand transforms:
Taking Mohand transform of system (1), we have

$$\left.\begin{aligned} M\left\{\frac{d^2x}{dt^2}\right\} + 3M\{x\} - 2M\{y\} = 0 \\ M\left\{\frac{d^2x}{dt^2}\right\} + M\left\{\frac{d^2y}{dt^2}\right\} - 3M\{x\} + 5M\{y\} = 0 \end{aligned}\right\} \quad (3)$$

Now using the property, Mohand transform of the derivatives of the function, in (3), we have

$$\left.\begin{aligned} v^2M\{x\} - v^3x(0) - v^2x'(0) + 3M\{x\} - 2M\{y\} = 0 \\ v^2M\{x\} - v^3x(0) - v^2x'(0) + v^2M\{y\} - v^3y(0) - v^2y'(0) - 3M\{x\} + 5M\{y\} = 0 \end{aligned}\right\} \quad (4)$$

Using (2) in (4), we have

$$\left.\begin{aligned} (v^2+3)M\{x\} - 2M\{y\} = 3v^2 \\ (v^2-3)M\{x\} + (v^2+5)M\{y\} = 5v^2 \end{aligned}\right\} \quad (5)$$

Solving the system (5) for $M\{x\}$and $M\{y\}$, we have

$$\left.\begin{aligned} M\{x\} = \frac{11}{4}\left[\frac{v^2}{(v^2+1)}\right] + \frac{1}{4}\left[\frac{v^2}{(v^2+9)}\right] \\ M\{y\} = \frac{11}{4}\left[\frac{v^2}{(v^2+1)}\right] - \frac{3}{4}\left[\frac{v^2}{(v^2+9)}\right] \end{aligned}\right\} \quad (6)$$

Now taking inverse Mohand transform of system (6), we have

$$\left.\begin{aligned} x = \frac{11}{4}sint + \frac{1}{12}sin3t \\ y = \frac{11}{4}sint - \frac{1}{4}sin3t \end{aligned}\right\} \quad (7)$$

which is the required solution of (1) with (2).

Solution using Elzaki transforms:

Taking Elzaki transform of system (1), we have

$$\left.\begin{aligned} E\left\{\frac{d^2x}{dt^2}\right\} + 3E\{x\} - 2E\{y\} = 0 \\ E\left\{\frac{d^2x}{dt^2}\right\} + E\left\{\frac{d^2y}{dt^2}\right\} - 3E\{x\} + 5E\{y\} = 0 \end{aligned}\right\} \quad (8)$$

Now using the property, Elzaki transform of the derivatives of the function, in (8), we have

$$\left.\begin{aligned} \frac{1}{v^2}E\{x\} - x(0) - vx'(0) + 3E\{x\} - 2E\{y\} = 0 \\ \frac{1}{v^2}E\{x\} - x(0) - vx'(0) + \frac{1}{v^2}E\{y\} - y(0) - vy'(0) - 3E\{x\} + 5E\{y\} = 0 \end{aligned}\right\} \quad (9)$$

Using (2) in (9), we have

$$\left.\begin{aligned} \left(\frac{1}{v^2}+3\right)E\{x\} - 2E\{y\} = 3v \\ \left(\frac{1}{v^2}-3\right)E\{x\} + \left(\frac{1}{v^2}+5\right)E\{y\} = 5v \end{aligned}\right\} \quad (10)$$

Solving the system (10) for $E\{x\}$ and $E\{y\}$, we have

$$\left.\begin{aligned} E\{x\} = \frac{11}{4}\left[\frac{v^3}{1+v^2}\right] + \frac{1}{4}\left[\frac{v^3}{1+9v^2}\right] \\ E\{y\} = \frac{11}{4}\left[\frac{v^3}{1+v^2}\right] - \frac{3}{4}\left[\frac{v^3}{1+9v^2}\right] \end{aligned}\right\} \quad (11)$$

Now taking inverse Elzaki transform of system (11), we have

$$\left.\begin{aligned} x = \frac{11}{4}sint + \frac{1}{12}sin3t \\ y = \frac{11}{4}sint - \frac{1}{4}sin3t \end{aligned}\right\} \quad (12)$$

which is the required solution of (1) with (2).

8.2 Consider a system of linear ordinary differential equations

$$\left.\begin{aligned}\frac{dx}{dt}+y=2cost\\ x+\frac{dy}{dt}=0\end{aligned}\right\} \tag{13}$$

with $x(0)=0, y(0)=1$ (14)

Solution using Mohand transforms:

Taking Mohand transform of system (13), we have

$$\left.\begin{aligned}M\left\{\frac{dx}{dt}\right\}+M\{y\}=2M\{cost\}\\ M\{x\}+M\left\{\frac{dy}{dt}\right\}=0\end{aligned}\right\} \tag{15}$$

Now using the property, Mohand transform of the derivatives of the function, in (15), we have

$$\left.\begin{aligned}vM\{x\}-v^2x(0)+M\{y\}=\frac{2v^3}{(v^2+1)}\\ M\{x\}+vM\{y\}-v^2y(0)=0\end{aligned}\right\} \tag{16}$$

Using (14) in (16), we have

$$\left.\begin{aligned}vM\{x\}+M\{y\}=\frac{2v^3}{(v^2+1)}\\ M\{x\}+vM\{y\}=v^2\end{aligned}\right\} \tag{17}$$

Solving the system (17) for $M\{x\}$and $M\{y\}$, we have

$$\left.\begin{aligned}M\{x\}=\left[\frac{v^2}{(v^2+1)}\right]\\ M\{y\}=\left[\frac{v^3}{(v^2+1)}\right]\end{aligned}\right\} \tag{18}$$

Now taking inverse Mohand transform of system (18), we have

$$\left.\begin{aligned}x=sint\\ y=cost\end{aligned}\right\} \tag{19}$$

which is the required solution of (13) with (14).

Solution using Elzaki transforms:

Taking Elzaki transform of system (13), we have

$$\left.\begin{aligned}E\left\{\frac{dx}{dt}\right\}+E\{y\}=2E\{cost\}\\ E\{x\}+E\left\{\frac{dy}{dt}\right\}=0\end{aligned}\right\} \tag{20}$$

Now using the property, Elzaki transform of the derivatives of the function, in (20), we have

$$\left.\begin{aligned}\frac{1}{v}E\{x\}-vx(0)+E\{y\}=\frac{2v^2}{1+v^2}\\ E\{x\}+\frac{1}{v}E\{y\}-vy(0)=0\end{aligned}\right\} \tag{21}$$

Using (14) in (21), we have

$$\left.\begin{aligned} \frac{1}{v}E\{x\} + E\{y\} = \frac{2v^2}{1+v^2} \\ E\{x\} + \frac{1}{v}E\{y\} = v \end{aligned}\right\} \quad (22)$$

Solving the system (22) for $E\{x\}$and $E\{y\}$, we have

$$\left.\begin{aligned} E\{x\} = \left[\frac{v^3}{1+v^2}\right] \\ E\{y\} = \left[\frac{v^2}{1+v^2}\right] \end{aligned}\right\} \quad (23)$$

Now taking inverse Elzaki transform of system (23), we have

$$\left.\begin{aligned} x = sint \\ y = cost \end{aligned}\right\} \quad (24)$$

which is the required solution of (13) with (14).

8.3 Consider a system of linear ordinary differential equations

$$\left.\begin{aligned} \frac{dz}{dt} + x = sint \\ \frac{dx}{dt} - y = e^t \\ \frac{dy}{dt} + z + x = 1 \end{aligned}\right\} \quad (25)$$

with $x(0) = 1, y(0) = 1, z(0) = 0$ (26)

Solution using Mohand transforms:

Taking Mohand transform of system (25), we have

$$\left.\begin{aligned} M\left\{\frac{dz}{dt}\right\} + M\{x\} = M\{sint\} \\ M\left\{\frac{dx}{dt}\right\} - M\{y\} = M\{e^t\} \\ M\left\{\frac{dy}{dt}\right\} + M\{z\} + M\{x\} = M\{1\} \end{aligned}\right\} \quad (27)$$

Now using the property, Mohand transform of the derivatives of the function, in (27), we have

$$\left.\begin{aligned} vM\{z\} - v^2z(0) + M\{x\} = \left[\frac{v^2}{(v^2+1)}\right] \\ vM\{x\} - v^2x(0) - M\{y\} = \left[\frac{v^2}{v-1}\right] \\ vM\{y\} - v^2y(0) + M\{z\} + M\{x\} = v \end{aligned}\right\} \quad (28)$$

Using (26) in (28), we have

$$\left.\begin{aligned} vM\{z\} + M\{x\} = \left[\frac{v^2}{(v^2+1)}\right] \\ vM\{x\} - M\{y\} = \left[\frac{v^3}{v-1}\right] \\ vM\{y\} + M\{z\} + M\{x\} = v + v^2 \end{aligned}\right\} \quad (29)$$

Solving the system (29) for $M\{x\}$, $M\{y\}$and $M\{z\}$, we have

$$\left.\begin{aligned} M\{x\} &= \left[\frac{v^2}{v-1}\right] + \left[\frac{v^2}{(v^2+1)}\right] \\ M\{y\} &= \left[\frac{v^3}{(v^2+1)}\right] \\ M\{z\} &= v - \left[\frac{v^2}{v-1}\right] \end{aligned}\right\} \tag{30}$$

Now taking inverse Mohand transform of system (30), we have

$$\left.\begin{aligned} x &= e^t + sint \\ y &= cost \\ z &= 1 - e^t \end{aligned}\right\} \tag{31}$$

which is the required solution of (25) with (26).

Solution using Elzaki transforms:

Taking Elzaki transform of system (25), we have

$$\left.\begin{aligned} E\left\{\frac{dz}{dt}\right\} + E\{x\} &= E\{sint\} \\ E\left\{\frac{dx}{dt}\right\} - E\{y\} &= E\{e^t\} \\ E\left\{\frac{dy}{dt}\right\} + E\{z\} + E\{x\} &= E\{1\} \end{aligned}\right\} \tag{32}$$

Now using the property, Elzaki transform of the derivatives of the function, in (32), we have

$$\left.\begin{aligned} \frac{1}{v}E\{z\} - vz(0) + E\{x\} &= \left[\frac{v^3}{1+v^2}\right] \\ \frac{1}{v}E\{x\} - vx(0) - E\{y\} &= \left[\frac{v^2}{1-v}\right] \\ \frac{1}{v}E\{y\} - vy(0) + E\{z\} + E\{x\} &= v^2 \end{aligned}\right\} \tag{33}$$

Using (26) in (33), we have

$$\left.\begin{aligned} \frac{1}{v}E\{z\} + E\{x\} &= \left[\frac{v^3}{(v^2+1)}\right] \\ \frac{1}{v}E\{x\} - E\{y\} &= \left[\frac{v}{1-v}\right] \\ \frac{1}{v}E\{y\} + E\{z\} + E\{x\} &= v^2 + v \end{aligned}\right\} \tag{34}$$

Solving the system (34) for $E\{x\}$, $E\{y\}$ and $E\{z\}$, we have

$$\left.\begin{aligned} E\{x\} &= \left[\frac{v^2}{1-v}\right] + \left[\frac{v^3}{1+v^2}\right] \\ E\{y\} &= \left[\frac{v^2}{1+v^2}\right] \\ E\{z\} &= v^2 - \left[\frac{v^2}{1-v}\right] \end{aligned}\right\} \tag{35}$$

Now taking inverse Elzaki transform of system (35), we have

$$\left.\begin{aligned} x &= e^t + sint \\ y &= cost \\ z &= 1 - e^t \end{aligned}\right\} \tag{36}$$

which is the required solution of (25) with (26).

IX. CONCLUSIONS

In this paper, we have successfully discussed the comparative study of Mohand and Elzaki transforms. In application section, we solve systems of differential equations (Homogeneous & Non-Homogeneous) comparatively using both the transforms. The numerical applications which are given in application section show that both the transforms (Mohand and Elzaki transforms) are closely connected to each other.

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