A Mathematical Comparison between Mohand Transform and Kamal Transform Methods

Andersen H.M.1 & El-Farouk A.R.2
*1 Department of Cardiology, Copenhagen Medical Institute, Copenhagen, Denmark
2 Department of Cardiovascular Sciences, Cairo Biomedical University, Cairo, Egypt

ABSTRACT

Mohand and Kamal transforms are very useful integral transforms for solving many advanced problems of engineering and sciences like heat conduction problems, vibrating beams problems, population growth and decay problems, electric circuit problems etc. In this article, we present a comparative study of two integral transforms namely Mohand and Kamal transforms. We solve some systems of differential equations using both the transforms in application section. Results show that Mohand and Kamal transforms are closely connected.

Keywords: Mohand transform, Kamal transform, System of differential equations

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I. INTRODUCTION

In modern time, 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 scholars [13-28] applied these transforms and solve the problems of real world which are mathematically represented by differential equations, delay differential equations, partial differential equations, partial integro-differential equations, integral equations, integro-differential equations. Aggarwal et al. [29] applied Mohand transform and solve the problems of population growth and decay. Aggarwal et al. [30] defined Mohand transform of Bessel's functions. Kumar et al. [31] used Mohand transform and solved linear Volterra integral equations of first kind.

Kumar et al. [32] gave the applications of Mohand transform for solving the mechanics and electrical circuit problems. Aggarwal et al. [33] used Mohand transform for solving linear Volterra integral equations of second kind. Sathya and Rajeswari [34] applied Mohand transform for solving linear partial integro-differential equations. Application of Mohand transform for solving linear Volterra integro-differential equations was given by Kumar et al. [35]. Aggarwal [36] defined Kamal transform of Bessel's functions. Abdelilah and Hassan [37] used Kamal transform for solving partial differential equations. Aggarwal et al. [38] gave a new application of Kamal transform for solving linear Volterra integral equations. Solution of linear partial integro-differential equations using Kamal transform was given by Gupta et al. [39]. Aggarwal et al. [40] applied Kamal transform for solving linear Volterra integral equations of first kind. Application of Kamal transform for solving population growth and decay problems was given by Aggarwal et al. [41]. Aggarwal and Chaudhary [42] gave a comparative study of Mohand and Laplace transforms.

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

II. DEFINITION OF MOHAND AND KAMAL TRANSFORMS

2.1 Definition of Mohand transforms:

In year 2017, Mohand and Mahgoub [6] defined "Mohand transform'' of the function $F(t)$ for $t \geq 0$ as

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

where the operator M is called the Mohand transform operator.

2.2 Definition of Kamal transforms:

In year 2016, Abdelilah and Hassan [3] defined “Kamal transform’’ of the function $F(t)$ for $t \geq 0$ as
$K\{F(t)\} = \int_0^\infty F(t)e^{\frac{-t}{v}}dt = G(v), k_1 \leq v \leq k_2,$
where the operator K is called the Kamal transform operator.

The Mohand and Kamal transforms of the function $F(t)$ for $t \geq 0$ exist if $F(t)$ is piecewise continuous and of exponential order. These conditions are only sufficient conditions for the existence of Mohand and Kamal transforms of the function $F(t)$.

III. PROPERTIES OF MOHAND AND KAMAL TRANSFORMS

In this section, we present the linearity property, change of scale property, first shifting theorem, convolution theorem of Mohand and Kamal transforms.

3.1 Linearity property of Mohand and Kamal 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 Kamal transforms [36, 41]:** If Kamal transform of functions $F_1(t)$ and $F_2(t)$ are $G_1(v)$ and $G_2(v)$ respectively then Kamal transform of $[aF_1(t) + bF_2(t)]$ is given by $[a\,G_1(v) + bG_2(v)]$, where a, b are arbitrary constants.

3.2 Change of scale property of Mohand and Kamal 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 Kamal transforms:** If Kamal transform of function $F(t)$ is $G(v)$ then Kamal transform of function $F(at)$ is given by $\frac{1}{a}G(av)$.

Proof: By the definition of Kamal transform, we have

$$K\{F(at)\} = \int_0^\infty F(at)e^{\frac{-t}{v}}dt \tag{1}$$

Put $at = p \Rightarrow adt = dp$ in equation(1), we have

$$K\{F(at)\} = \frac{1}{a}\int_0^\infty F(p)e^{\frac{-p}{av}}dp$$

$$\Rightarrow K\{F(at)\} = \frac{1}{a}G(av)$$

3.3 Shifting property of Mohand and Kamal 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 Kamal transforms:** If Kamal transform of function $F(t)$ is $G(v)$ then Kamal transform of function $e^{at}F(t)$ is given by $G\left(\frac{v}{1-av}\right)$.

Proof: By the definition of Kamal transform, we have

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

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

3.4 Convolution theorem for Mohand and Kamal 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 Kamal transforms [36, 38, 40]: If Kamal transform of functions $F_1(t)$ and $F_2(t)$are $G_1(v)$and $G_2(v)$ respectively then Kamal transform of their convolution $F_1(t)*F_2(t)$ is given by

$$K\{F_1(t)*F_2(t)\}=K\{F_1(t)\}K\{F_2(t)\}$$

$\Rightarrow K\{F_1(t)*F_2(t)\}=G_1(v)\,G_2(v)$, 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 KAMAL 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) $M\{F'(t)\}=vR(v)-v^2F(0)$

b) $M\{F''(t)\}=v^2R(v)-v^3F(0)-v^2F'(0)$

c) $M\{F^{(n)}(t)\}=v^nR(v)-v^{n+1}F(0)-v^nF'(0)-\cdots\ldots-v^2F^{(n-1)}(0)$

4.2 Kamal transforms of the derivatives of the function $F(t)$ [3, 36, 39, 41]:

If $K\{F(t)\}=G(v)$then

a) $K\{F'(t)\}=\frac{1}{v}G(v)-F(0)$

b) $K\{F''(t)\}=\frac{1}{v^2}G(v)-\frac{1}{v}F(0)-F'(0)$

c) $K\{F^{(n)}(t)\}=\frac{1}{v^n}G(v)-\frac{1}{v^{n-1}}F(0)-\frac{1}{v^{n-2}}F'(0)\ldots\ldots-F^{(n-1)}(0)$

V. MOHAND AND KAMAL TRANSFORMS OF FREQUENTLY USED FUNCTIONS [29-33, 3, 36, 38, 40-42]

Table: 1

S.N.	$F(t)$	$M\{F(t)\}=R(v)$	$K\{F(t)\}=G(v)$
1.	1	v	v
2.	t	1	v^2
3.	t^2	$\frac{2!}{v}$	$2!\,v^3$
4.	$t^n, n\in N$	$\frac{n!}{v^{n-1}}$	$n!\,v^{n+1}$
5.	$t^n, n>-1$	$\frac{\Gamma(n+1)}{v^{n-1}}$	$\Gamma(n+1)v^{n+1}$
6.	e^{at}	$\frac{v^2}{v-a}$	$\frac{v}{1-av}$
7.	$\sin at$	$\frac{av^2}{(v^2+a^2)}$	$\frac{av^2}{1+a^2v^2}$
8.	$\cos at$	$\frac{v^3}{(v^2+a^2)}$	$\frac{v}{1+a^2v^2}$
9.	$\sinh at$	$\frac{av^2}{(v^2-a^2)}$	$\frac{av^2}{1-a^2v^2}$
10.	$\cosh at$	$\frac{v^3}{(v^2-a^2)}$	$\frac{v}{1-a^2v^2}$

11.	$J_0(t)$	$\frac{v^2}{\sqrt{(1+v^2)}}$	$\frac{v}{\sqrt{(1+v^2)}}$
12.	$J_1(t)$	$v^2 - \frac{v^3}{\sqrt{(1+v^2)}}$	$1 - \frac{1}{\sqrt{(1+v^2)}}$

VI. INVERSE MOHAND AND KAMAL 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 Kamal transforms [36, 38, 41]: If $G(v)$ is the Kamal transforms of $F(t)$then $F(t)$ is called the inverse Kamal transform of $G(v)$and in mathematical terms, it can be expressed as
$F(t) = K^{-1}\{G(v)\}$, where K^{-1} is an operator and it is called as inverse Kamal transform operator.

VII. INVERSE MOHAND AND KAMAL TRANSFORMS OF FREQUENTLY USED FUNCTIONS [29, 36, 38, 41-42]

Table: 2

S.N.	$R(v)$	$F(t) = M^{-1}\{R(v)\} = K^{-1}\{G(v)\}$	$G(v)$
1.	v	1	v
2.	1	t	v^2
3.	$\frac{1}{v}$	$\frac{t^2}{2}$	v^3
4.	$\frac{1}{v^{n-1}}$	$\frac{t^n}{n!}, n \in N$	v^{n+1}
5.	$\frac{1}{v^{n-1}}$	$\frac{t^n}{\Gamma(n+1)}, n > -1$	v^{n+1}
6.	$\frac{v^2}{v-a}$	e^{at}	$\frac{v}{1-av}$
7.	$\frac{v^2}{(v^2+a^2)}$	$\frac{\text{sinat}}{a}$	$\frac{v^2}{1+a^2v^2}$
8.	$\frac{v^3}{(v^2+a^2)}$	cosat	$\frac{v}{1+a^2v^2}$
9.	$\frac{v^2}{(v^2-a^2)}$	$\frac{\text{sinhat}}{a}$	$\frac{v^2}{1-a^2v^2}$
10.	$\frac{v^3}{(v^2-a^2)}$	coshat	$\frac{v}{1-a^2v^2}$
11.	$\frac{v^2}{\sqrt{(1+v^2)}}$	$J_0(t)$	$\frac{v}{\sqrt{(1+v^2)}}$
12.	$v^2 - \frac{v^3}{\sqrt{(1+v^2)}}$	$J_1(t)$	$1 - \frac{1}{\sqrt{(1+v^2)}}$

VIII. APPLICATIONS OF MOHAND AND KAMAL 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 Kamal transforms.

8.1 Consider a system of linear ordinary differential equations

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

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

Solution using Mohand transforms:

Taking Mohand transform of system (2), we have

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

Now using the property, Mohand transform of the derivatives of the function, in (4), we have

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

Using (3) in (5), we have

$$\left.\begin{aligned} (v^2+3)M\{x\} - 2M\{y\} = 3v^2 \\ (v^2-3)M\{x\} + (v^2+5)M\{y\} = 5v^2 \end{aligned}\right\} \quad (6)$$

Solving the system (6) for $M\{x\}$and $M\{y\}$, we have

$$\left.\begin{aligned} M\{x\} = \frac{11}{4}\left[\frac{v^2}{(v^2+1)}\right] + \frac{1}{4}\left[\frac{v^2}{(v^2+9)}\right] \\ M\{y\} = \frac{11}{4}\left[\frac{v^2}{(v^2+1)}\right] - \frac{3}{4}\left[\frac{v^2}{(v^2+9)}\right] \end{aligned}\right\} \quad (7)$$

Now taking inverse Mohand transform of system (7), we have

$$\left.\begin{aligned} x = \frac{11}{4}sint + \frac{1}{12}sin3t \\ y = \frac{11}{4}sint - \frac{1}{4}sin3t \end{aligned}\right\} \quad (8)$$

which is the required solution of (2) with (3).

Solution using Kamal transforms:

Taking Kamal transform of system (2), we have

$$\left.\begin{aligned} K\left\{\frac{d^2x}{dt^2}\right\} + 3K\{x\} - 2K\{y\} = 0 \\ K\left\{\frac{d^2x}{dt^2}\right\} + K\left\{\frac{d^2y}{dt^2}\right\} - 3K\{x\} + 5K\{y\} = 0 \end{aligned}\right\} \quad (9)$$

Now using the property, Kamal transform of the derivatives of the function, in (9), we have

$$\left.\begin{aligned} \frac{1}{v^2}K\{x\} - \frac{1}{v}x(0) - x'(0) + 3K\{x\} - 2K\{y\} = 0 \\ \frac{1}{v^2}K\{x\} - \frac{1}{v}x(0) - x'(0) + \frac{1}{v^2}K\{y\} - \frac{1}{v}y(0) - y'(0) - 3K\{x\} + 5K\{y\} = 0 \end{aligned}\right\} \quad (10)$$

Using (3) in (10), we have

$$\left.\begin{aligned} \left(\frac{1}{v^2}+3\right)K\{x\} - 2K\{y\} = 3 \\ \left(\frac{1}{v^2}-3\right)K\{x\} + \left(\frac{1}{v^2}+5\right)K\{y\} = 5 \end{aligned}\right\} \quad (11)$$

Solving the system (11) for $K\{x\}$ and $K\{y\}$, we have

$$\left.\begin{aligned} K\{x\} &= \frac{11}{4}\left[\frac{v^2}{1+v^2}\right] + \frac{1}{4}\left[\frac{v^2}{1+9v^2}\right] \\ K\{y\} &= \frac{11}{4}\left[\frac{v^2}{1+v^2}\right] - \frac{3}{4}\left[\frac{v^2}{1+9v^2}\right] \end{aligned}\right\} \quad (12)$$

Now taking inverse Kamal transform of system (12), we have

$$\left.\begin{aligned} x &= \frac{11}{4}sint + \frac{1}{12}sin3t \\ y &= \frac{11}{4}sint - \frac{1}{4}sin3t \end{aligned}\right\} \quad (13)$$

which is the required solution of (2) with (3).

8.2 Consider a system of linear ordinary differential equations

$$\left.\begin{aligned} \frac{dx}{dt} + y &= 2cost \\ x + \frac{dy}{dt} &= 0 \end{aligned}\right\} \quad (14)$$

with $x(0) = 0, y(0) = 1$ (15)

Solution using Mohand transforms:

Taking Mohand transform of system (14), we have

$$\left.\begin{aligned} M\left\{\frac{dx}{dt}\right\} + M\{y\} &= 2M\{cost\} \\ M\{x\} + M\left\{\frac{dy}{dt}\right\} &= 0 \end{aligned}\right\} \quad (16)$$

Now using the property, Mohand transform of the derivatives of the function, in (16), we have

$$\left.\begin{aligned} vM\{x\} - v^2x(0) + M\{y\} &= \frac{2v^3}{(v^2+1)} \\ M\{x\} + vM\{y\} - v^2y(0) &= 0 \end{aligned}\right\} \quad (17)$$

Using (15) in (17), we have

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

Solving the system (18) for $M\{x\}$and $M\{y\}$, we have

$$\left.\begin{aligned} M\{x\} &= \left[\frac{v^2}{(v^2+1)}\right] \\ M\{y\} &= \left[\frac{v^3}{(v^2+1)}\right] \end{aligned}\right\} \quad (19)$$

Now taking inverse Mohand transform of system (19), we have

$$\left.\begin{aligned} x &= sint \\ y &= cost \end{aligned}\right\} \quad (20)$$

which is the required solution of (14) with (15).

Solution using Kamal transforms:

Taking Kamal transform of system (14), we have

$$\left.\begin{aligned} K\left\{\frac{dx}{dt}\right\} + K\{y\} &= 2K\{cost\} \\ K\{x\} + K\left\{\frac{dy}{dt}\right\} &= 0 \end{aligned}\right\} \quad (21)$$

Now using the property, Kamal transform of the derivatives of the function, in (21), we have

$$\left.\begin{aligned} \frac{1}{v}K\{x\} - x(0) + K\{y\} &= \frac{2v}{1+v^2} \\ K\{x\} + \frac{1}{v}K\{y\} - y(0) &= 0 \end{aligned}\right\} \quad (22)$$

Using (15) in (22), we have

$$\left.\begin{aligned}\frac{1}{v}K\{x\}+K\{y\}&=\frac{2v}{1+v^2}\\ K\{x\}+\frac{1}{v}K\{y\}&=1\end{aligned}\right\}\qquad(23)$$

Solving the system (23) for $K\{x\}$and $K\{y\}$, we have

$$\left.\begin{aligned}K\{x\}&=\left[\frac{v^2}{1+v^2}\right]\\ K\{y\}&=\left[\frac{v}{1+v^2}\right]\end{aligned}\right\}\qquad(24)$$

Now taking inverse Kamal transform of system (24), we have

$$\left.\begin{aligned}x&=sint\\ y&=cost\end{aligned}\right\}\qquad(25)$$

which is the required solution of (14) with (15).

8.3 Consider a system of linear ordinary differential equations

$$\left.\begin{aligned}\frac{dz}{dt}+x&=sint\\ \frac{dx}{dt}-y&=e^t\\ \frac{dy}{dt}+z+x&=1\end{aligned}\right\}\qquad(26)$$

with $x(0)=1, y(0)=1, z(0)=0$ (27)

Solution using Mohand transforms:

Taking Mohand transform of system (26), we have

$$\left.\begin{aligned}M\left\{\frac{dz}{dt}\right\}+M\{x\}&=M\{sint\}\\ M\left\{\frac{dx}{dt}\right\}-M\{y\}&=M\{e^t\}\\ M\left\{\frac{dy}{dt}\right\}+M\{z\}+M\{x\}&=M\{1\}\end{aligned}\right\}\qquad(28)$$

Now using the property, Mohand transform of the derivatives of the function, in (28), we have

$$\left.\begin{aligned}vM\{z\}-v^2z(0)+M\{x\}&=\left[\frac{v^2}{(v^2+1)}\right]\\ vM\{x\}-v^2x(0)-M\{y\}&=\left[\frac{v^2}{v-1}\right]\\ vM\{y\}-v^2y(0)+M\{z\}+M\{x\}&=v\end{aligned}\right\}\qquad(29)$$

Using (27) in (29), we have

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

Solving the system (30) for $M\{x\}$, $M\{y\}$and $M\{z\}$, we have

$$\left.\begin{aligned}M\{x\}&=\left[\frac{v^2}{v-1}\right]+\left[\frac{v^2}{(v^2+1)}\right]\\ M\{y\}&=\left[\frac{v^3}{(v^2+1)}\right]\\ M\{z\}&=v-\left[\frac{v^2}{v-1}\right]\end{aligned}\right\}\qquad(31)$$

Now taking inverse Mohand transform of system (31), we have

$$\left.\begin{aligned} x &= e^t + sint \\ y &= cost \\ z &= 1 - e^t \end{aligned}\right\} \quad (32)$$

which is the required solution of (26) with (27).

Solution using Kamal transforms:

Taking Kamal transform of system (26), we have

$$\left.\begin{aligned} K\left\{\frac{dz}{dt}\right\} + K\{x\} &= K\{sint\} \\ K\left\{\frac{dx}{dt}\right\} - K\{y\} &= K\{e^t\} \\ K\left\{\frac{dy}{dt}\right\} + K\{z\} + K\{x\} &= K\{1\} \end{aligned}\right\} \quad (33)$$

Now using the property, Kamal transform of the derivatives of the function, in (33), we have

$$\left.\begin{aligned} \frac{1}{v}K\{z\} - z(0) + K\{x\} &= \left[\frac{v^2}{1+v^2}\right] \\ \frac{1}{v}K\{x\} - \mathrm{x}(0) - K\{y\} &= \left[\frac{v}{1-v}\right] \\ \frac{1}{v}K\{y\} - y(0) + K\{z\} + K\{x\} &= v \end{aligned}\right\} \quad (34)$$

Using (27) in (34), we have

$$\left.\begin{aligned} \frac{1}{v}K\{z\} + K\{x\} &= \left[\frac{v^2}{(v^2+1)}\right] \\ \frac{1}{v}K\{x\} - K\{y\} &= \left[\frac{1}{1-v}\right] \\ \frac{1}{v}K\{y\} + K\{z\} + K\{x\} &= v + 1 \end{aligned}\right\} \quad (35)$$

Solving the system (35) for $K\{x\}$, $K\{y\}$ and $K\{z\}$, we have

$$\left.\begin{aligned} K\{x\} &= \left[\frac{v}{1-v}\right] + \left[\frac{v^2}{1+v^2}\right] \\ K\{y\} &= \left[\frac{v}{1+v^2}\right] \\ K\{z\} &= v - \left[\frac{v}{1-v}\right] \end{aligned}\right\} \quad (36)$$

Now taking inverse Kamal transform of system (36), we have

$$\left.\begin{aligned} x &= e^t + sint \\ y &= cost \\ z &= 1 - e^t \end{aligned}\right\} \quad (37)$$

which is the required solution of (26) with (27).

IX. CONCLUSIONS

In this paper, we have successfully discussed the comparative study of Mohand and Kamal 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 Kamal transforms) are closely connected to each other.

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