International Journal of Advances in Engineering and Management (IJAEM)
Volume 7, Issue 03 Mar. 2025, pp: 405-415 www.ijaem.net ISSN: 2395-5252

Taki transform and its applications

Rachid El Aitouni[1] and Dinkar P. Patil[2]
1Laboratory of Theoretical Physics, Faculty of Sciences,
Chouaıb Doukkali University, PO Box 20, 24000 El Jadida, Morocco *
2Arts and Commerce College, Wadala (Nashik), India

Date of Submission: 10-03-2025 Date of Acceptance: 20-03-2025

ABSTRACT: In this study, we introduced a new integral transformation called the Taki transform. We examined the properties of this transformation and demonstrated that all integral transformations, from the Laplace transform to the latest ones such as Emad-Falih transforms and AR-Transform, are special cases of this transformation. Furthermore, we demonstrated the ease to use this integral transform for solving differential equations with constant coefficients de first or second ordre.
PACS numbers: 78.67.Wj, 05.40.-a, 05.60.-k, 72.80.Vp

Keywords: Taki transform, defferential equation.

I. INTRODUCTION

Integral transformations are very important tools for solving differential equations with linear coefficients and for transitioning from one space to another to facilitate computation. Since the creation of the first Laplace transformation in 1780 by the mathematician P. S. Laplace [1], it has played a significant role in the field of physics for solving ordinary differential equations. However, its effectiveness remains limited. In 1822, Fourier proposed his transformation, which became the most widely used transformation in the field of signal processing. The success of these two transformations paved the way for the search for new simple and easy transformations for solving differential equations.

Among these transformations are the Sumudi transformation in 1993 [2], the Nature transformation in 2008 [3], the Elzaki transformation in 2011 [4],the Aboodh transformation (2013) [5], the Tarig transformtion (2013) [6], the Kamal transform (2016) [7], the Maghroub transformation (Laplace-Carson) (2016) [8], the Mohaned transformation (2017) [9], the Shuhu transformation (2019) [10] and the Sawi transformation (2019) [11] · · · , Following these integral transforms, I propose a new integral transform called the ”Taki transform”. This integral transform generalizes 37 integral transforms starting with Laplace and ending with the latest integral transforms such as Emad-Sara or Emad-Falih transform [16, 17] and AR-Transform [30].

This paper is organized as follows: In Section (II), we present our integral transform, as well as its properties and their connections with other integral transforms, along with some applications for solving first and second-order differential equations. We will conclude our paper with a general conclusion in Section (III).

II. NEWINTEGRALTRANSFORM

In this section, we introduce a comprehensive integral transform that encompasses most, if not all, types of integral transforms within the family of Laplace transforms. For the present investigation, we recall the following definitions.

DefinitionII.1*We consider functions of exponential order in the set A,definedby*

$$A = \left\{ f(t)\, with\, |f(t)| < Me^{\frac{|t|}{k_j}},\ if\, t \in (-1)^j \times [0, \infty[\, with j = 1, 2\ and\, M, k_1, k_2 > 0) \right\},$$

For a given function in the set A, the constant M must be a finite number, while k1 and k2 may be finite or infinite. The Taki transform denoted by the operator TK(.), defined by the integral equation:

International Journal of Advances in Engineering and Management (IJAEM)
Volume 7, Issue 03 Mar. 2025, pp: 405-415 www.ijaem.net ISSN: 2395-5252

$$TK[f(t)] = TK(s) = s^{\alpha} \int_{0}^{+\infty} f(ut) e^{-s^{\beta} t} dt \qquad \text{(II.1)}$$

with t > 0, k1 < s < k2, α ∈ Z, β ∈ Z∗ and u is a reel numbre. The inverse of the Taki transform is denoted by TK−1(.).

DefinitionII.2 If TK[f(t)] = F(s) then the inverse Taki transform is defined as

$$TK^{-1}[F(s)] = f(t). \qquad \text{(II.2)}$$

The Taki transform is a generalization of the majority of known integral transformats to date (about 37 integral transforms), and it can also generalize similar transformations proposed in the future. Our goal is to demonstrate the ease of use of this integral transform for solving linear coefficient differential equations.

In the following, Table I explores the connections between the Taki transform and the other integral transforms by modifying the values of α, β and u.

TABLE I. Relations between the Taki transform and the well-known transforms.

Sr. No.	α	β	u	Name of integral transform	Expression of integral transform
1	0	1	1	Laplace transform [1]	$\int_0^\infty e^{-st} f(t)dt$
2	-1	-1	1	Sumudu transform [2]	$\frac{1}{s}\int_0^\infty e^{-\frac{t}{s}} f(t)dt$
3	0	-α	1	α-Integral Laplace Transform [12]	$\int_0^\infty e^{-\frac{t}{s^\alpha}} f(t)dt$
4	1	1	u	Natural transform [3]	$\int_0^\infty e^{-st} f(ut)dt$
5	1	-1	1	Elzaki transform [4]	$s\int_0^\infty e^{-\frac{t}{s}} f(t)dt$
6	-1	1	1	Aboodh transform [5]	$\frac{1}{s}\int_0^\infty e^{-st} f(t)dt$
7	-1	-2	1	Tarig transform [6]	$\frac{1}{s}\int_0^\infty e^{-\frac{t}{s^2}} f(t)dt$
8	0	-1	1	Kamal transform [7]	$\int_0^\infty e^{-\frac{t}{s}} f(t)dt$
9	1	1	1	Laplace – Carson Transform [8]	$s\int_0^\infty e^{-st} f(t)dt$
10	2	1	1	Mohaned transform [9]	$s^2\int_0^\infty e^{-st} f(t)dt$
11	-2	-1	1	Sawi transform [11]	$\frac{1}{s^2}\int_0^\infty e^{-\frac{t}{s}} f(t)dt$
12	1	2	1	Pourrez transform [13]	$s\int_0^\infty e^{-s^2 t} f(t)dt$
12	α	-1	1	G-transform [14]	$s^\alpha\int_0^\infty e^{-\frac{t}{s}} f(t)dt$
14	0	1	1	Shehu transform [10]	$\int_0^\infty e^{-rt} f(t)dt$, with $r = \frac{s}{v}$
15	1	α	1	Kushore transform [20]	$s\int_0^\infty e^{-s^\alpha t} f(t)dt$
16	-1	α	1	Sohane transform [19]	$\frac{1}{s}\int_0^\infty e^{-s^\alpha t} f(t)dt$
17	-β	α	1	Sadik transform [15]	$\frac{1}{s^\beta}\int_0^\infty e^{-s^\alpha t} f(t)dt$
18	-n	1	1	SEE-transform [18]	$\frac{1}{s^n}\int_0^\infty e^{-st} f(t)dt$
19	-2	1	1	Emad-Sara transform [17]	$\frac{1}{s^2}\int_0^\infty e^{-st} f(t)dt$
20	-1	2	1	Emad-Falih transform [16]	$\frac{1}{s}\int_0^\infty e^{-s^2 t} f(t)dt$
21	1	2	1	HY Transform [21]	$s\int_0^\infty e^{-s^2 t} f(t)dt$
22	-1	-2	1	Kashuri and Fundo transform [22]	$\frac{1}{s}\int_0^\infty e^{-\frac{t}{s^2}} f(t)dt$
23	1	1	u	ZZ Transform [23]	$s\int_0^\infty e^{-st} f(ut)dt$
24	1	1	1	Mahgoub Transform [24]	$s\int_0^\infty e^{-st} f(t)dt$
25	0	-1	1	Yang Transform [25]	$\int_0^\infty e^{-\frac{1}{s}t} f(t)dt$
26	3	-2	1	Kharrat Toma Transform [26]	$s^3\int_0^\infty e^{-\frac{1}{s^2}t} f(t)dt$

International Journal of Advances in Engineering and Management (IJAEM)
Volume 7, Issue 03 Mar. 2025, pp: 405-415 www.ijaem.net ISSN: 2395-5252

27	m	n	1	W-Transform [27]	$s^m \int_0^\infty e^{-s^n t} f(t)$
28	α	-1	1	G-Transform [28]	$s^\alpha \int_0^\infty e^{-\frac{1}{s}t} f(t)dt$
29	1	1	u	Formable Transform [28]	$s \int_0^\infty e^{-st} f(ut)dt$
30	2	-1	1	Anuj Transform [29]	$s^2 \int_0^\infty e^{-\frac{1}{s}t} f(t)dt$
31	-2	-2	1	AR Transform [30]	$\frac{1}{s^2} \int_0^\infty e^{-\frac{t}{s^2}} f(t)dt$
32	-1	-1	1	ZMA Transform [31]	$\frac{1}{s} \int_0^\infty e^{-\frac{t}{s}} f(t)dt$
33	-2	2	1	IMAN Transform [32]	$\frac{1}{s^2} \int_0^\infty e^{-s^2 t} f(t)dt$
34	3	1	1	Rohit Transform [33]	$s^3 \int_0^\infty e^{-st} f(t)dt$
35	5	1	1	DV Transform [34]	$s^5 \int_0^\infty e^{-st} f(t)dt$
36	-3	1	1	Gupta Transform [35]	$\frac{1}{s^3} \int_0^\infty e^{-st} f(t)dt$
37	-1	1	u	KKATTransform [36]	$\frac{1}{s} \int_0^\infty e^{-st} f(ut)dt$

TAKI INTEGRAL TRANSFORM OF SOME FUNCTIONS

The Taki transform is necessary to satisfy the following condition t > 0, we can writte it in the following form

$$TK[f(t)] = s^\alpha \int_0^{+\infty} f(ut) e^{-s^\beta t} dt = \frac{s^\alpha}{u} \int_0^{+\infty} f(t) e^{-\frac{s^\beta}{u}t} dt \qquad \text{(II.3)}$$

1. f(t)=1 $\Rightarrow TK[1] = \frac{s^\alpha}{u} \int_0^{+\infty} e^{-\frac{s^\beta}{u}t} dt = \frac{\frac{s^\alpha}{u}}{\frac{s^\beta}{u}}$

2. f(t)=t $\Rightarrow TK[t] = \frac{s^\alpha}{u} \int_0^{+\infty} t e^{-\frac{s^\beta}{u}t} dt = u \frac{s^\alpha}{s^{2\beta}}$

3. f(t)=t^2 $\Rightarrow TK[t^2] = \frac{s^\alpha}{u} \int_0^{+\infty} t^2 e^{-\frac{s^\beta}{u}t} dt = 2u^2 \frac{s^\alpha}{s^{3\beta}}$

4. f(t)=t^n $\Rightarrow TK[t^n] = \frac{s^\alpha}{u} \int_0^{+\infty} t^n e^{-\frac{s^\beta}{u}t} dt = n! u^n \frac{s^\alpha}{s^{(n+1)\beta}}$, where $n \in \mathbb{N}^*$

5. f(t)=e^{at} $\Rightarrow TK[e^{at}] = \frac{s^\alpha}{u} \int_0^{+\infty} e^{at} e^{-\frac{s^\beta}{u}t} dt = \frac{s^\alpha}{s^\beta - a}$

6. $f(t)=\sin at \Rightarrow TK[\sin at]=\frac{s^{\alpha}}{u}\int_{0}^{+\infty}\sin ate^{-\frac{s^{\beta}}{u}t}dt=\frac{a\frac{s^{\alpha}}{u}}{(\frac{s^{\beta}}{u})^{2}+a^{2}}$

7. $f(t)=\cos at \Rightarrow TK[\cos at]=\frac{s^{\alpha}}{u}\int_{0}^{+\infty}\cos ate^{-\frac{s^{\beta}}{u}t}dt=\frac{\frac{s^{\alpha}}{u}.\frac{s^{\beta}}{u}}{(\frac{s^{\beta}}{u})^{2}+a^{2}}$

8. $f(t)=\sinh at \Rightarrow TK[\sinh at]=\frac{s^{\alpha}}{u}\int_{0}^{+\infty}\sin ate^{-\frac{s^{\beta}}{u}t}dt=\frac{a\frac{s^{\alpha}}{u}}{(\frac{s^{\beta}}{u})^{2}-a^{2}}$

9. $f(t)=\cosh at \Rightarrow TK[\cosh at]=\frac{s^{\alpha}}{u}\int_{0}^{+\infty}\cos ate^{-\frac{s^{\beta}}{u}t}dt=\frac{\frac{s^{\alpha}}{u}.\frac{s^{\beta}}{u}}{(\frac{s^{\beta}}{u})^{2}-a^{2}}$

TAKI TRANSFORM OF DERIVATIVE

Let f(t) be a function derivable in R, the Taki transform of its derivative is written as follows:

1. $f'(\text{t}) \Rightarrow \text{TK}[f'(\text{t})]=\frac{s^{\beta}}{u}TK[f(t)]-\frac{s^{\alpha}}{u}f(0)$
2. $f''(\text{t}) \Rightarrow \text{TK}[f''(\text{t})]=(\frac{s^{\beta}}{u})^{2}TK[f(t)]-\frac{s^{\alpha}}{u}\frac{s^{\beta}}{u}f(0)-\frac{s^{\alpha}}{u}f'(0)$
3. $f^{(n)}(\text{t}) \Rightarrow \text{TK}[f^{(n)}(\text{t})]=(\frac{s^{\beta}}{u})^{n}TK[f(t)]-\frac{s^{\alpha}}{u}\sum_{k=0}^{n-1}(\frac{s^{\beta}}{u})^{n-1-k}f^{(k)}(0)$

Proof:

1. Let $f'(\text{t})$ then, $\text{TK}[f'(\text{t})]=\frac{s^{\alpha}}{u}\int_{0}^{+\infty}f'(t)e^{-\frac{s^{\beta}}{u}t}dt$, using the integration by parts, which yields $TK[f'(t)]=\frac{s^{\beta}}{u}TK[f(t)]-\frac{s^{\alpha}}{u}f(0)$.
2. Let $f''(\text{t})$ then, $\text{TK}[f''(\text{t})]=\frac{s^{\alpha}}{u}\int_{0}^{+\infty}f''(t)e^{-\frac{s^{\beta}}{u}t}dt$, using the integration by parts, which yields $TK[f'(t)]=\frac{s^{\beta}}{u}TK[f'(t)]-\frac{s^{\alpha}}{u}f(0)$, utilize the transformation of the first derivative to get: $\text{TK}[f''(\text{t})]=(\frac{s^{\beta}}{u})^{2}TK[f(t)]-\frac{s^{\alpha}}{u}\frac{s^{\beta}}{u}f(0)-\frac{s^{\alpha}}{u}f'(0)$

3. follow the same approach.

THE APPLICATION OF THE TAKI INTEGRAL TRANSFORM TO ORDINARY DIFFERENTIAL EQUATIONS

The Taki transformation is a simple mathematical tool designed to ease the resolution of differential equations with constant coefficients.

In general, the first-order differential equation is written as follows

$$\frac{df(t)}{dt}+\text{p}.f(t)=\text{g}(t), \qquad \text{(II.4)}$$

where f(t) is a frequent function, f(0) = a and a, p are constants. To solve such a differential equation applying the Taki transform, we get

$$TK\left[\frac{\mathrm{df(t)}}{\mathrm{dt}}\right]+TK\left[\mathrm{p.f}(t)\right]=TK\left[\mathrm{g}\left(\mathrm{t}\right)\right]. \quad \text{(II.5)}$$

Now, using the property of the Taki transform of derivative, one finds

$$-\frac{s^{\alpha}}{u}f(0)+\frac{s^{\beta}}{u}TK\left[f(t)\right]+pTK\left[f(t)\right]=TK\left[g(t)\right] \quad \text{(II.6)}$$

and after some manipulations, this equation yields the following identity

$$TK\left[x\right]\left[\frac{s^{\beta}}{u}+p\right]=TK\left[g(t)\right]+a\frac{s^{\alpha}}{u} \quad \text{(II.7)}$$

Therefore

$$TK\left[f(t)\right]=\frac{TK\left[g(t)\right]}{\left[\frac{s^{\beta}}{u}+p\right]}+\frac{s^{\alpha}}{u}a \quad \text{(II.8)}$$

Finally, To obtain the solution, we utilize the inverse transform.

Example 1: For this example, we solve the discharge equation using our new transform where R is the resistance and C is the capacitance of the capacitor. The differential equation for the discharge is written as follows

$$\frac{dq}{dt}+\frac{1}{RC}q=0 \quad \text{(II.9)}$$

with q(0) = q0. So, p = 1 /RC a = q0, and f(t)=0. Taking the Taki transform, and after some calculations, one finds

$$TK\left[q(t)\right]=q_0\frac{\frac{s^{\alpha}}{u}}{\left[\frac{s^{\alpha}}{u}-(-p)\right]}. \quad \text{(II.10)}$$

Applying the inverse transform provides the solution to the differential equation under consideration, which is

$$q(t)=q_0e^{-\frac{1}{RC}t}$$

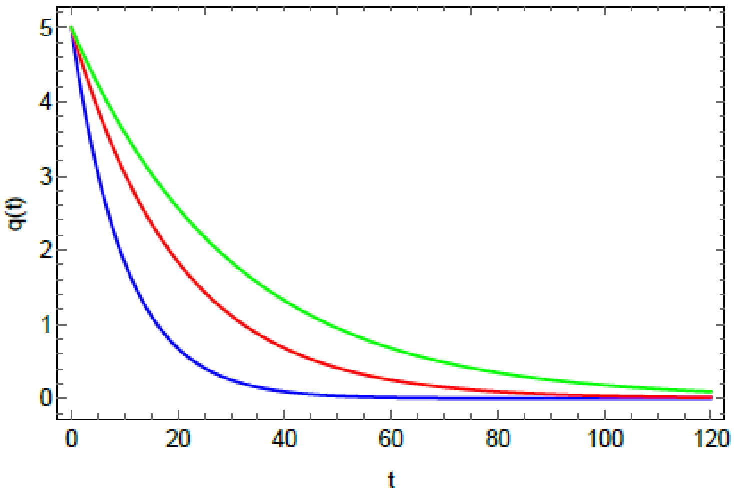

FIG. 1. Analytical solution of (II.9) for 3 values of the resistance R; blue for R = 10kΩ, red for R = 20kΩ, and green for R = 30kΩ, with q0 = 5 and C = 1000μF.

Figure 1 presents the evolution of the discharge of the capacitor in an RC circuit as a function of time. It is evident from the figure that, during the discharge process, the charge decreases exponentially, and the increase in resistance slightly delays the capacitor's discharge.

Example 2: Here, we solve a first-order differential equation with the second side written as follows

$$\frac{dy}{dx} + 2y = x, \qquad y(0) = 1. \tag{II.11}$$

Applying the Taki transform, to get

$$TK\left[y(x)\right] = \frac{\frac{s^\alpha}{u}}{(\frac{s^\beta}{u})^2\left[\frac{s^\beta}{u} + 2\right]} + \frac{\frac{s^\alpha}{u}}{\left[\frac{s^\beta}{u} + 2\right]} \tag{II.12}$$

then

$$TK\left[y(x)\right] = \frac{5}{4}\frac{\frac{s^\alpha}{u}}{\left[\frac{s^\beta}{u} + 2\right]} + \frac{1}{2}\frac{\frac{s^\alpha}{u}}{(\frac{s^\beta}{u})^2} - \frac{1}{4}\frac{\frac{s^\alpha}{u}}{\frac{s^\beta}{u}} \tag{II.13}$$

Applying the inverse transform to obtain

$$y(x) = \frac{5}{4}e^{-2x} + \frac{1}{2}x - \frac{1}{4}. \tag{II.14}$$

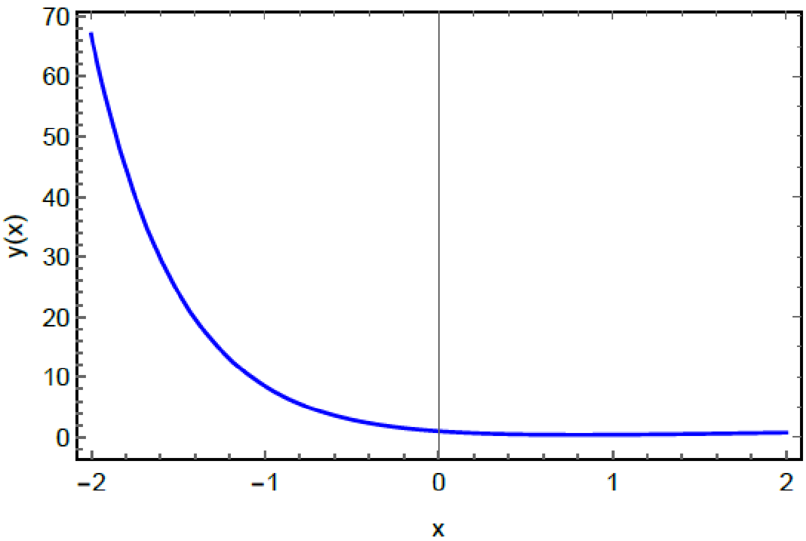

FIG. 2. Analytical solution of (II.14).

SECOND-ORDER DIFFERENTIAL EQUATIONS

Second-order differential equations are widely used in the field of physics, such as in harmonic oscillators or equations of motion. Therefore, we require simple techniques for their resolution. The Taki transformation is straightforward to apply in this context. A second-order differential equation is generally expressed in the following form:

$$\frac{d^2 f(t)}{dt^2} + 2p\frac{df(t)}{dt} + qf(t) = g(t), \qquad (II.15)$$

with y(0) = a and y′(0) = b. Applying the Taki transformation, considering the initial conditions, and utilizing the properties of derivatives, we find

$$(\frac{s^\beta}{u})^2 TK[f(t)] - \frac{s^\alpha}{u}\frac{s^\beta}{u}f(0) - \frac{s^\alpha}{u}f'(0) + 2p\left[\frac{s^\beta}{u}TK[f(t)] - \frac{s^\alpha}{u}f(0)\right] + qTK[f(t)] = TK[g(t)] \qquad (II.16)$$

then

$$TK[f(t)] = \frac{TK[g(t)] + a\frac{s^\alpha}{u}(2p + \frac{s^\beta}{u}) + b\frac{s^\alpha}{u}}{(\frac{s^\beta}{u})^2 + 2p\frac{s^\beta}{u} + q} \qquad (II.17)$$

After determining the transform of our function, we apply the inverse transform to find the exact solution.

Example 3: The harmonic oscillator is a significant concept in physics as it allows for the description of the behavior around an equilibrium position of numerous physical systems under defined approximation conditions. Consider a mass m brought to its center of inertia G, coinciding with the origin of the coordinate system x(0) = 0, attached to a massless linear spring with stiffness k, and placed on a horizontal planar support with initial velocity v0. The harmonic equation of motion is written as follows:

$$x'' + \frac{k}{m}x = 0 \qquad (II.18)$$

International Journal of Advances in Engineering and Management (IJAEM)
Volume 7, Issue 03 Mar. 2025, pp: 405-415 www.ijaem.net ISSN: 2395-5252

Now we apply the Taki transform, and after simplification, we arrive at

$$TK\left[x(t)\right]=\frac{v_0}{\omega}\frac{\omega\frac{s^{\alpha}}{u}}{(\frac{s^{\beta}}{u})^2+\omega^2} \quad \text{(II.19)}$$

with $\omega=\sqrt{\frac{k}{m}}$. Taking the inverse transform, to obtain $x\left(t\right)=\frac{v_0}{\omega}sin\left(\omega t\right)$.

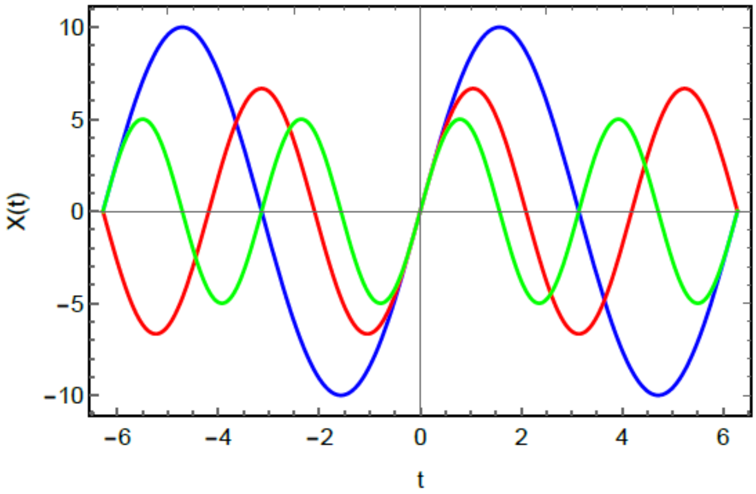

FIG. 3. Analytical solution of (II.18), for three value of ω.

Example 4: We will solve in this example a second-order differential equation with the second-side written as follows

$$\frac{d^2f(t)}{dt^2}+9f(t)=sin\left(2t\right), \quad f(0)=0, f'(0)=1 \quad \text{(II.20)}$$

Now we apply the Taki transformation

$$TK\left[f(t)\right]=\frac{TK\left[sin(2t)\right]}{((\frac{s^{\beta}}{u})^2+9)}+\frac{\frac{s^{\alpha}}{u}}{((\frac{s^{\beta}}{u})^2+9)} \quad \text{(II.21)}$$

Utilizing the cosine transformation and after a simple calculation, we find

$$TK\left[f(t)\right]=\frac{2\frac{s^{\alpha}}{u}}{((\frac{s^{\beta}}{u})^2+4)}\frac{1}{((\frac{s^{\beta}}{u})^2+9)}+\frac{\frac{s^{\alpha}}{u}}{((\frac{s^{\beta}}{u})^2+9)} \quad \text{(II.22)}$$

therefore

$$TK\left[f(t)\right]=\frac{1}{5}\frac{2\frac{s^{\alpha}}{u}}{((\frac{s^{\beta}}{u})^2+2^2)}+\frac{1}{5}\frac{3\frac{s^{\alpha}}{u}}{((\frac{s^{\beta}}{u})^2+3^2)} \quad \text{(II.23)}$$

Taking the inverse transform of this expression, to find

$$y(t)=\frac{1}{5}\sin(2t)+\frac{1}{5}\sin(3t) \quad \text{(II.24)}$$

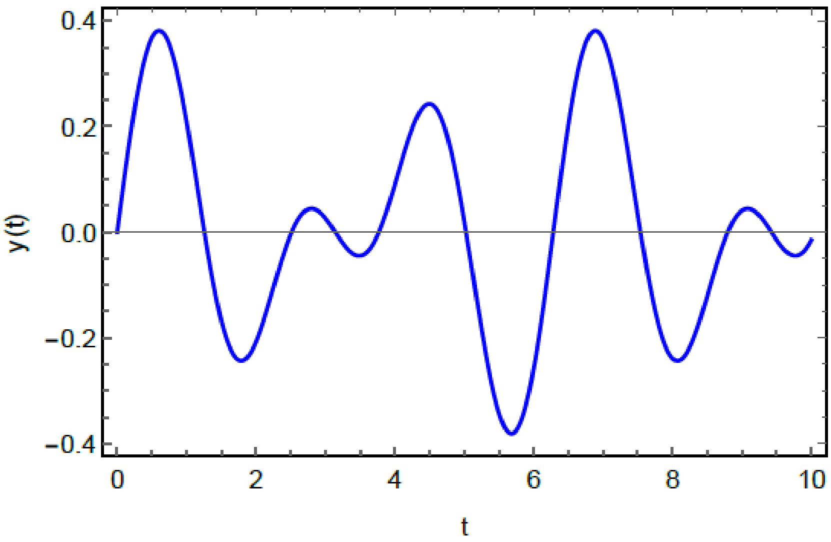

FIG. 4. Analytical solution of (II.20).

III. CONCLUSION

In this work, we have introduced and applied a new generalized Taki transform on some usual functions and solved some differential equations in the first and second orders. We have study the fundamental properties, dualities with known transforms and applications in the context of a unification of integral transforms. We have shown that the Taki transform converts to the well-known transforms like the Laplace, Sumudu, Natural, Elzaki, Aboodh, Tarig, Kamal, Laplace-Carson, Mohaned, Shehu, Sawi, Pourrez, Emad-Sara, Emad-Filah, and Kushoe transforms. We conclude that the Taki transform remains a new generalized integral transform that not only solves differential equations and systems of equations but also produces the results of all the previous published integral transforms.

REFERENCE

[1]. M. R. Spiegel, ”Laplace transforms”, New York: McGraw-Hill (1965) 249.
[2]. S. Bochner and K. Chandrasekharan, “Fourier transforms”, Princeton University Press, New York, (19) (1949).
[3]. Z. H. Khan and W.A. Khan, ”N-transform - Properties and applications.” NUST Journal of Eng. Sc., 1 (1) (2008) 127-133.
[4]. T. M. Elzaki, “The new integral transform “Elzaki transform””, Global Journal of Pure and Applied Mathematics, 7 (1) (2011) 57–64.
[5]. K. S. Aboodh, “The new integral transform “Aboodh transform””, Global Journal of Pure and Applied Mathematics, 9 (1) (2013) 35-43.
[6]. T. M. Elzaki and M.E. Salih, “New integral transform: “Tarig Transform” and system of integro differential equations”,Elixir Appl. Math, 57 (5) (2013), 13982-13985.
[7]. A. Kamal and H. Sedeeg, “The new integral transform “Kamal transform””, Advances In Theoretical and Applied Mathematics, 11 (4) (2016) 451-458.
[8]. M. A. M. Mahgoub, “The new integral transform “Mahgoub transform””, Advances in theoretical and applied mathematics, 11(4) (2016) 391-398.
[9]. M. Mohand and A. Mahgoub. ”The new integral transform “Mohand transform””, Advances in Theoretical and Applied Mathematics, 12 (2) (2017) 113-120.
[10]. M. W. Z. Shehu, “New integral transform: Shehu transform a generalization of Sumudu and Laplace transform for solving differential equations”, International Journal of Analysis and Applications, 17 (2) (2019) 167-190.
[11]. M. A. M. Mahgoub, “The new integral transform Sawi transform”, Advances in Theoretical and Applied Mathematics, 14 (1) (2019) 81-87.
[12]. G. D. Medina, N. R. Ojeda, J. H. Pereira, and L. G. ”Romero. Fractional laplace transform and fractional

calculus", Int Mathe Forum, 12(20) (2017) 991–1000.

[13]. S. A. P. Ahmadi, H. Hosseinzadeh, and A. Y. Cherati, "A new integral transform for solving higher order linear ordinarydifferential equations", Nonlinear Dyn Syst Theory 19(2) (2019) 243–52.

[14]. H. Kim, "On the form and properties of an integral transform with strength in integral transforms", Far East J Mathe Sci102(11) (2017) 2831–44.

[15]. S. L. Shaikh, "Introducing a new integral transform: Sadik Transform. American International Journal of Research in Science", Technology, Engineering and Mathematics, 22(1) (2018) 100-102.

[16]. E. Kuffi and S. F. Maktoof, "Emad-Falih Transform" a new integral transform. Journal of Interdisciplinary Mathematics, 24(8) (2021) 2381-2390.

[17]. S. F. Maktoof, E. Kuffi, and E. S. Abbas, ""Emad-Sara Transform" a new integral transform". Journal of Interdisciplinary Mathematics, 24(7) (2021) 1985-1994.

[18]. E. A. Mansour, E. A. Kuffi, and S. A. Mehdi, "The new integral transform "SEE transform" and its applications". Periodicals of engineering and natural sciences, 9(2) (2021) 1016-1029.

[19]. D. P .Patil, Savita Santu Khakale, "The New Integral Transform "Soham Transform"", International Journal of Advances in Engineering and Management (IJAEM), 3 (2021) 126-132.

[20]. S. R. Kushare, D. P. Patil, D. P., and A. M. Takate, "The new integral transform,"Kushare transform". InternationalJournal of Advances in Engineering and Management, 3(9) (2021) 1589-1592.

[21]. Patil D. P., Gangurde J. P., Wagh, S. N. and Bachhav, T. P.: Applications of the HY Transform for Newtons Law ofCooling. International Journal of Research and Analytical Reviews, 9(2), (2022) 740-745.

[22]. Jinam A. Jasim, Emad A. Kuffi and Sadik A. Mehdi; A review on the integral transform, Journal of University of Anbar for Pure Science, 17(2) (2023) 273-310.

[23]. Zafar Zain UI Abadin: ZZ Transform method . International Journal of Advanced Engineering and Global Technology , 4(1) (2016) 1605-1611.

[24]. Mahgoub Mohand M. Abdelrahim: The New Integral Transform, " Mahgoub Transform". Advances in Theoretical and Applied Mathematics, 11(4) (2016) 391-398.

[25]. Yang Xian-Jun: A New Integral Transform Method for Solving Steady Heat Transfer Problem. Thermal Science, 20 (3) (2016) 639-642.

[26]. Mustapha, R.A., Salau, A. M. , Bahatunde Idowu, Ogbai, C. O. and Idowu, G. A. : Kharrat Toma Transform and its Application in Solving Some Ordinary Differential Equations with Initial Boundary Conditions. International Journal of Innovative Science and Research Technology, 6(8) (2021) 224-229.

[27]. Ping Wang, Xin-Yu Peng and Fang Wang; The analysis and application of a new integral transform W transform, Thermal Sciences, 27(5) (2023) 3823-3827.

[28]. Lalitmohan Upadhyaya : Introducing the Upadhyaya Integral Transform. Bulletin of Pure and Applied Sciences, (Math and Stat) 38(1) (2019) 471-510.

[29]. Anuj kumar, Shikha Bansal and Sudhanshu Aggarwal: A New Novel Integral Transform Anuj Transform with Applications, Design Engineering, 9 (2021) 12741-12751.

[30]. Muhammad Akbar and Rashid Mawaz, Introducing a New Integral Transform Called AR- Transform, Journal of Mathematical Techniques in Modelling, 1(1) (2024) 1-10.

[31]. Zanib Mohammed Alwan, ZMA transform Technique, Journal of Interdisciplinary Mathematics, 24(7) (2021) 1841-1849.

[32]. Iman Ahmed Almardy, The new integral transform, "Iman transform" International Journal of Advanced Research in Science, Communication and Technology, 3(1) (2023) 1-5.

[33]. Rohit Gupta; On novel integral transform: Rohit transform and its applications in boundary value problems, ASIO Journal of Chemistry, Physics, Mathematics and Applied Sciences,4(1) (2020) 8-13.

[34]. Dinesh Verma; Putting forward a novel

integral transform " Dinesh Verma Transform" and its applications, International Journal of Scientific Research in Mathematical and Statistical Sciences, 7(2) (2020) 139-145.

[35]. Rahul Gupta, Rohit Gupta and Dinesh Verma; Application of Novel integral transform: Gupta transform to mechanical and electrical oscillators, ASIO Journal of Chemistry, Physics, Mathematics and Applied Sciences, 4(1) (2020) 4-7.

[36]. Karry Iqbal, Muhammad Kalim and Adnan Khan; Application of Karry-Kalim-Adnan transformation(KKAT) to mechanics and electric circuits, Journal of Function Space, 2022(1) (2022) 1-11.