NTU Journal for Administrative and Human Sciences / Special Issue
DOI: https://doi.org/10.56286/ntujahs

JAHS NTU

P-ISSN: 2789-1240 E-ISSN:2789-1259
NTU Journal for Administrative and Human Sciences
Available online at: https://journals.ntu.edu.iq/index.php/NTU-JMS/index

Solution of First Order Complex Differential Equations by complex Sadik Transform Technique

1st Shatha H. Theyab[1] , 2nd Emad A. Kuffi[2] , 3rd Noor k. Salaamn[3] ,4th Eman A. Mansour[4] , 5rt Ahmad Issa[5]
[1,2,3] Department of Mathematics, College of Basic Education, Mustansiriyah University, Iraq Baghdad.
[4] Department of Electrical Technologies , Southern Technical University , Technical Institute Nasiriyah , Iraq .
[5] Department of Mathematics, Faculty of science, Karabuk University, Turkey.

Article Informations

Received : 15, 09, 2024
Accepted : 14, 07, 2024
Published online : 01, 11, 2024

Corresponding author :
Name : Nour K. Salman
Affiliation : Department of Mathematics, College of Basic Education, Mustansiriyah University, Iraq Baghdad.
Email:noorkareem94@uomustansiriyah.edu.iq

Key Words:
The Complex Sadik transform , Complex Differential Equation , Partial Derivatives.

A B S T R A C T

In this paper, we introduce the complex Sadik integral transform to evaluate the exact solution of first order complex differential equations with constant coefficients . this technique offers a practical and fast strategy for resolving a variety of linear operator problems.

Introduction

integral transformations are extremely effective solve lots of advanced science engineering problems. Many papers have applied various integral transformations (Laplace, Sumudu , SEE , … ,etc.) and solved ordinary and partial differential equations and integral operator equations and their applications [3, 4, 5, 6, 7, 10].

A system of partial differential equations with two variables of unknown independent variants can be created from many complex differential equations. Separating actual parties from fictitious ones [8,5].Solving linear ordinary differential equation is one application of the complex Sadik integral transform ,which is employed in many applications and fields of mathematics [8].Due to the nonlinear variables , this technique Cannot be utilized to solve nonlinear differential equations .Never the less nonlinear differential equations can be resolved with the help of a differential transform and the complex Sadik technique.

In this work , we introduce the first order complex differential equations with constant coefficients .
By applying Laplace , Aboodh and SEE integral transform were resolved [2 ,9] . Definition and a basic theorem are presented first. Contains numerical examples after that.

Fundamental Definition

Laplace integral transformation and other integral Transformations defined in the time domain where t is grater than or equal zero , including the Sumudu , Elzaki , and SEE l transformations , are analogous to the complex Sadik integral transformation.

Functions of exponential order are defined applying the complex Sadik transformation . We take into account the functions in the set H defined as , [1] :

$H = \{g(t)\ :\ there\ exists\ AM\ , G_1\ , G_2 > 0\ such\ that\ |g(t)| < M\ e^{-iG_j|t|}$
$,\ if\ t \in (-1)^j\ X\ [0\ ,\ \infty)\ , where\ j = 1,2\}\ where\ i^2\ = -1.$

Where M is a constant must be a finite number for a particular function in the set H , and G_1 , G_2 may be finite or infinite. The integral equation then defines the complex Sadik transform indicated by $S_{\mathrm{a}}{}^{c}\{g(t)\}$:

$$S_{\mathrm{a}}{}^{c}\{g(t)\} = F^{c}\,(s^{\alpha},\beta)\ =\ \frac{1}{S^{\beta}}\int_0^{\infty} g(t)\, e^{-is^{\alpha}t}\,dt \qquad ...(1)$$

Where $s \in \mathbb{C}$, $\mathrm{Im}(s^{\alpha}) < 0\ , \beta\ , \alpha \in \mathcal{R}\ , \mathrm{i}^2\ = -1$, [1]

The Complex Sadik Transform (CST) for some Basic Fundamental Functions [1 ,8]

In this part , we explain and show some important functions have (CST) :

1- $S_{\mathrm{a}}{}^{c}\{\ t^{m}\} = (-i\ )^{m+1}\ \frac{m!}{S^{m\alpha+(\alpha+\beta)}}\ \ where\ s > 0\ and\ \ m \in \mathbb{N}\ .$

2- $S_{\mathrm{a}}{}^{c}\{e^{bt}\} = \frac{-1}{S^{\beta}}\ [\frac{b}{(S^{2\alpha}+b^2)} + \frac{iS^{\alpha}}{(S^{2\alpha}+b^2)}]\ where\ s > b\ , b\ is\ a\ constant.$

3- $S_{\mathrm{a}}{}^{c}\{sin(bt)\} = \frac{-b}{S^{\beta}(S^{2\alpha}-b^2)}\ \ \ , s > |b|\ , b\ is\ a\ constant.$

4- $S_{\mathrm{a}}{}^{c}\{cos(bt)\} = \frac{-is^{\alpha}}{S^{\beta}(S^{2\alpha}-b^2)}\ \ \ , s > |b|\ , b\ is\ a\ constant.$

5- $S_{\mathrm{a}}{}^{c}\{sinh(bt)\} = \frac{-b}{S^{\beta}(S^{2\alpha}+b^2)}\ \ \ , s > 0\ , b\ is\ a\ constant.$

6- $S_{\mathrm{a}}{}^{c}\{cosh(bt)\} = \frac{-is^{\alpha}}{S^{\beta}(S^{2\alpha}+b^2)}\ \ \ , s > 0\ , b\ is\ a\ constant.$

The Complex Sadik Technique (CST) of Partial Derivative

To create the complex Sadik integral transform of the partial derivatives , we apply the method of integration by parts as follows:

$$S_a^c\left\{\frac{\partial g(x,t)}{\partial t}\right\}=\frac{1}{S^\beta}\int_0^\infty \left(\frac{\partial g}{\partial t}\right)e^{-is^\alpha t}\quad dt\,,$$
$$=\lim_{r\to\infty}\frac{1}{S^\beta}\int_0^r \left(\frac{\partial g}{\partial t}\right)e^{-is^\alpha t}\ dt\,,$$
$$=\lim_{r\to\infty}\left(\left[\frac{1}{S^\beta}e^{-is^\alpha t}\ \ g(x,t)\ \right]_\circ^r+i\frac{1}{S^\beta}s^\alpha\int_0^r e^{-is^\alpha t}\ \ g(x,t)dt\right),$$
$$S_a^c\left\{\frac{\partial g}{\partial t}(x,t)\right\}=is^\alpha\ \ S_a^c(x,s)-\frac{1}{S^\beta}g(x,0)\,. \qquad ...(2)$$

Assume that g is a piecewise continuous with exponential order.
Now,

$$S_a^c\left\{\frac{\partial g}{\partial t}(x,t)\right\}=\frac{1}{S^\beta}\int_o^\infty \left(\frac{\partial g}{\partial t}(x,t)\right)e^{-iv^\alpha t}\quad dt\,,$$
$$=\frac{\partial}{\partial x}\left[\frac{1}{S^\beta}\int_0^\infty g(x,t)e^{-iv^\alpha t}\ \ dt\right]\quad \textit{(By applying Leibnitz Rule).}$$

$$S_a^c\left\{\frac{\partial g}{\partial t}(x,t)\right\}=\frac{\partial}{\partial x}[F^c\ (x,s)\ ]=\frac{d}{dx}[F^c\ (x,s)]\,.$$

Also , we can find:
$$S_a^c\left\{\frac{\partial^2 g}{\partial x^2}(x,t)\right\}=\frac{d^2}{dx^2}[F^c\ (x,s)\ ]$$
To find:
$$S_a^c\left\{\frac{\partial^2 g}{\partial x^2}(x,t)\right\}.$$
Assume that $f=\frac{\partial g}{\partial t}$,the by applying equation (2) , we get:
$$S_a^c\left\{\frac{\partial^2 g}{\partial x^2}(x,t)\right\}=S_a^c\left\{\frac{\partial f}{\partial t}(x,t)\right\},$$

$$=is^\alpha\ \ S_a^c f(x,t)-\frac{1}{S^\beta}f(x,0)$$
$$=is^\alpha\ \ [\ is^\alpha\ \ F^c(x,s)-\frac{1}{S^\beta}g(x,0)\ -\frac{1}{S^\beta}\frac{\partial g}{\partial x}(x\,,0)\ \ .$$
then
$$S_a^c\left\{\frac{\partial^2 g}{\partial t^2}(x,t)\right\}=(\ is^\alpha\ \ )^2\ F^c(x,s)-\frac{is^\alpha}{S^\beta}g(x,0)\ -\frac{1}{S^\beta}\frac{\partial g}{\partial t}(x,0)\ \ .$$

Linearity property of CST , [1]

Let $S_a^c\{g(t)\}=F^c\ (s)\ \ and\ \ S_a^c\{h(t)\}=\ H^c\ (s)\ \ then\ for$
every A and B are constants:
$$S_a^c\{Ag(t\ )\ \pm\ Bh(t)\ \}=A\,S_a^c\{g(t)\}\pm B\,S_a^c\{h(t\ )\ \},$$
$$=AF^c(s)\pm BH^c(s)\ \ .$$

Complex Derivative , [9]

Let $W=W(Z\,,\bar{Z})$ be a complex function , where the complex number $Z=x+iy$, and complex functiond $W(Z,\bar{Z})=u(x,y)\ +\ iv\ (x,y)$. First order derivatives according to $Z\ and\ \overline{Z}\ \ of\ \ W(Z,\bar{Z})$ are defined by follows:

$$\frac{\partial W}{\partial Z}=\ W_Z\ =\ \frac{1}{2}\ \left(\frac{\partial W}{\partial x}-i\frac{\partial W}{\partial y}\right) \qquad ...(3)$$

$$\frac{\partial W}{\partial \bar{Z}}=\ W_{\bar{Z}}\ =\ \frac{1}{2}\ \left(\frac{\partial W}{\partial x}+i\frac{\partial W}{\partial y}\right) \qquad ...(4)$$

Solution of First Order Complex Differential Equations with Constant Coefficients via Complex Sadik Transform

In this section , we introduce the following important theorem with examples:

Theorem(7.1): *let a , b* and c be real numbers *,* $G(Z,\bar{Z})$
is a polynomial *of* Z *and* $\bar{Z}$ *and* $W = u + iv$ *is a complex* function then the real *Re(W)* and imaginary parts *Im(W) of* solution of:

$$a\frac{\partial W}{\partial z} + b\frac{\partial W}{\partial \bar{z}} + CW = G(Z,\bar{Z}) \ , \qquad ...(5)$$

and $W(x,0) = 0$ *,*

are

$$u = F^{c^{-1}}\{\frac{(a+b)\frac{\partial}{\partial x}[2F_3{}^{C}(x,s)+(a-b)\frac{1}{s^{\beta}}v(x,0)]+2c[(2F_3{}^{C}(x,s)+(a-b)\frac{1}{s^{\beta}}v(x,0)}{\triangle} - \frac{(a-b)is^{\alpha}[2F_4{}^{C}(x,s)+(b-a)\frac{1}{s^{\beta}}u(x,0)]}{\triangle}\}.$$

$$V = F^{c^{-1}}\{\frac{(a+b)\frac{\partial}{\partial x}[2F_4{}^{C}(x,s)+(b-a)\frac{1}{s^{\beta}}u(x,0)]+2c[(2F_4{}^{C}(x,s)+(b-a)\frac{1}{s^{\beta}}u(x,0)]}{\triangle} - \frac{(b-a)is^{\alpha}[2F_3{}^{C}(x,s)+(a-b)v(x,0)]}{\triangle}\}.$$

Where $\Delta = \begin{vmatrix}(a+b)D+2C & (a-b)is^{\alpha}\\ (a-b)is^{\alpha} & (a+b)D+2C\end{vmatrix} = ((a+b)D + 2C + (is^{\alpha}(a-b))^2$

And $F_1{}^{C}$ $F_2{}^{C}$ $F_3{}^{C}$ $F_4{}^{C}$ *are integral transform of* u , v , G_1 , G_2 *respectively.*

Proof

We use equations (3)and (4)in equation (5) ,we have

$$\frac{a}{2}(\frac{\partial W}{\partial x} - i\frac{\partial W}{\partial y}) + \frac{b}{2}(\frac{\partial W}{\partial x} + i\frac{\partial W}{\partial y}) + cW = G_1(Z,\bar{Z}) + i\, G_2(Z,\bar{Z}) \qquad ...(6)$$

If we choose $W = u + iv$ *in equation (6) , following equation is obtained:*

$$a(\frac{\partial u}{\partial x} + i\frac{\partial v}{\partial x} - \frac{\partial u}{\partial y} + i\frac{\partial v}{\partial y}) + b(\frac{\partial u}{\partial x} + i\frac{\partial v}{\partial x} + \frac{\partial u}{\partial y} - i\frac{\partial v}{\partial y}) + 2CW$$

$$= 2\, G_1(x,y) + i\, G_2(x,y) \qquad ...(7)$$

If equation (7) is separated to real and imaginary parts , then the following system is obtained:

$$(a+b)\frac{\partial u}{\partial x} + (a-b)\frac{\partial v}{\partial y} + 2Cu = 2\, G_1(x,y)\,, \qquad ...(8)$$

$$(a+b)\frac{\partial v}{\partial x} + (b-a)\frac{\partial u}{\partial y} + 2Cv = 2\, G_2(x,y)\,. \qquad ...(9)$$

By using complex Sadik Transform (CST) for above equations , then we get the following equations:

$$(a+b)\frac{\partial F_1{}^{C}}{\partial x} + (a-b)(iS^{\alpha}F_2{}^{C} - \frac{1}{s^{\beta}}v(x,0)) + 2CF_1{}^{c} = 2CF^{c}\,, \qquad ...(10)$$

$$(a+b)\frac{\partial F_2{}^{C}}{\partial x} + (a-b)(iS^{\alpha}F_1{}^{C} - \frac{1}{s^{\beta}}u(x,0)) + 2CF_2{}^{c} = 2CF_4{}^{c}\,. \qquad ...(11)$$

If equations (10) and (11) is regulate and is applied Crammer rule , then

equations are obtained:

$$(a+b)\frac{\partial F_1{}^{C}}{\partial x} + (a-b)is^{\alpha}F_2{}^{C} + 2CF_1{}^{c} = 2CF_3{}^{c} + (a-b)\ \frac{1}{s^{\beta}}v(x,0),$$

$$(a+b)\frac{\partial F_2{}^{C}}{\partial x} + (b-a)is^{\alpha}F_1{}^{C} + 2CF_2{}^{c} = 2CF_4{}^{c} + (b-a)\ \frac{1}{s^{\beta}}u(x,0),$$

$$F_1{}^c = \frac{\begin{vmatrix} 2F_3{}^c + (a-b)\frac{1}{S^\beta}v(x,0) & (a-b)iS^\alpha \\ 2F_4{}^c + (b-a)\frac{1}{S^\beta}u(x,0) & (b-a)D+2C \end{vmatrix}}{\Delta} \quad . \qquad \text{...(12)}$$

And

$$F_2{}^c = \frac{\begin{vmatrix} (a+b)D+2C & 2F_3{}^c + (a-b)\frac{1}{S^\beta}v(x,0) \\ (b-a)iS^\alpha & 2F_4{}^c + (b-a)\frac{1}{S^\beta}u(x,0) \end{vmatrix}}{\Delta} \quad ,$$

$$F_2{}^c = \frac{(a+b)\frac{\partial}{\partial x}[2F_4{}^c(x,s) + (b-a)\frac{1}{S^\beta}u(x,0)] + 2C\,[2F_4{}^c(x,s) + (b-a)\frac{1}{S^\beta}u(x,0)]}{\Delta}$$

$$-\frac{(a-b)iS^\alpha[2F_4{}^c(x,s) + (a-b)\frac{1}{S^\beta}v(x,0)]}{\Delta} \quad . \qquad \text{...(13)}$$

Following are obtained form inverse CST of equations (12)and (13):

$$u(x,s) = F^{c^{-1}}\{\frac{(a+b)\frac{\partial}{\partial x}[2F_3{}^c(x,s) + (a-b)\frac{1}{S^\beta}v(x,0)] + 2C\,[2F_3{}^c(x,s) + (a-b)\frac{1}{S^\beta}v(x,0)]}{\Delta}$$

$$-\frac{(a-b)iS^\alpha[2F_4{}^c(x,s) + (b-a)\frac{1}{S^\beta}\,u(x,0)}{\Delta}\} , \qquad \text{...(14)}$$

$$v(x\,,y)\;F^{c^{-1}}\{\frac{(a+b)\frac{\partial}{\partial x}[F_4{}^c(x,s) + (b-a)\frac{1}{S^\beta}u(x,0)] + 2C\,[2F_4{}^c(x,s) + (b-a)\frac{1}{S^\beta}u(x,0)]}{\Delta}$$

$$-\frac{(b-a)iS^\alpha[2F_3{}^c(x,s) + (a-b)\frac{1}{S^\beta}\,v(x,0)]}{\Delta}\} . \qquad \text{... (15)}$$

Example (7.1): The complex differential equation

$3\frac{\partial W}{\partial Z} + \frac{\partial W}{\partial \bar{Z}} = 0$,

with condition $W(x,0) = x^2$.

Coefficients of the above equation are $a = 3$, $b = 1$, $c = 0$

And $(x,y) = 0$. *Form the theorem (7.1) , we have :*

$\Delta = (a+b)D + 2c)^2 + (is^\propto(b-a))^2 = 16D^2 + 4(is^\propto)^2$.

And

$$u(x,y) = F^{c^{-1}}\{\frac{-2is^\propto(\frac{1}{S^\beta}x^2)}{16D^2 + 4(is^\propto)^2} = F^{c^{-1}}\{\frac{i\frac{s^\propto}{S^\beta}x^2}{4D^2 + (is^\propto)^2}\} ,$$

$$u(x,y) = F^{c^{-1}}\{\frac{\frac{1}{S^\beta}x^2}{is^\propto[(\frac{2D}{is^\propto})^2 + 1]} = F^{c^{-1}}\{\frac{S^{-\beta}}{is^\alpha}[1 - (\frac{2D}{is^\alpha})^2]\; x^2\} ,$$

$$u(x,y) = F^{c^{-1}}\{\frac{S^{-\beta}}{is^\alpha}[x^2 - \frac{8}{(is^\alpha)^2}]\} ,$$

$u(x,y) = x^2 F^{c^{-1}}\{\frac{s^{-\beta}}{is}\} - \ 8F^{c^{-1}}\{\frac{s^{-\beta}}{(is^{\alpha})^3}\ \}$,

$$u(x,y) = x^2 F^{c^{-1}}\{\frac{(-i)s^{-\beta}}{s^{\alpha}}\} - \ 8F^{c^{-1}}\{\frac{(-i)^3 s^{-\beta}}{s^{3\alpha}}\ \} = x^2 - 4y^2$$

And on the other hand:

$v(x,y) = F^{c^{-1}}\{\ 4\frac{\partial}{\partial x}[\frac{-2is^{\alpha}x^2}{16\mathrm{D}^2+4(\mathrm{is}^{\alpha})^2}]\ \}$,

$= \ -16F^{c^{-1}}\{\frac{s^{-\beta}x}{4[4\mathrm{D}^2+(\mathrm{is}^{\alpha})^2]}\}$,

$= \ -4F^{c^{-1}}\{\frac{s^{-\beta}x}{(\mathrm{is}^{\alpha})^2[(\frac{2\mathrm{D}}{\mathrm{is}^{\alpha}})^2+1]}\}$,

$= \ -4F^{c^{-1}}\{\frac{s^{-\beta}}{(\mathrm{is}^{\alpha})^2}[1-(\frac{2D}{\mathrm{is}^{\alpha}})^2]\ x\ \}$,

$= \ -4F^{c^{-1}}\{\frac{xs^{-\beta}}{(\mathrm{is}^{\alpha})^2}\}$,

Then $v(x,y) \ = \ -4xF^{c^{-1}}\{\frac{(-i)^2}{\mathrm{s}^{2\alpha+\beta}}\} = -4xy$.

So we obtain
$w = u + iv = x^2 - 4y^2 - 4ixy$.

Example (7.2) Consider the following complex differential equation :

$\frac{\partial W}{\partial z} + 2\frac{\partial W}{\partial z} = Z$,

With condition $W(x,0) = x$

Coefficients of the above equation are $a = 1$, $b = 2$, $c = 0$

And $(x,y) = x + iy$ *. Form the theorem (7.1) , we have :*

$\Delta = (\mathrm{a}+\mathrm{b})\mathrm{D} + 2\mathrm{C})^2 \ + (\mathrm{is}^{\alpha}\,(\mathrm{b}-\mathrm{a}))^2 \ = 9\mathrm{D}^2 + (\mathrm{is}^{\alpha})^2$.

And

$$u(x,y) = F^{c^{-1}}\ \{\frac{3\frac{\partial}{\partial x}\ [\frac{2x(-\mathrm{is}^{\beta})}{\mathrm{s}^{\alpha}}] + \mathrm{is}^{\alpha}[\frac{2(-\mathrm{i})^2 s^{\beta})}{\mathrm{s}^{2\alpha}} + 2s^{-\beta}\mathrm{x}]}{9\mathrm{D}^2 + (\mathrm{is}^{\alpha})^2}\}\ ,$$

After simple computations , we get:

$u(x,y) = F^{c^{-1}}\{\frac{8(-\mathrm{i})^3 s^{-\beta})}{\mathrm{s}^{3\alpha}}\}\ + xF^{c^{-1}}\{\frac{(-\mathrm{i})s^{-\beta}}{\mathrm{s}^{\alpha}}\}$,

$u(x,y) = 4y^2 + x$

And on the other hand:

$$v(x,y) = F^{c^{-1}}\left\{\frac{3\frac{\partial}{\partial x}\left[\frac{2(-\mathrm{i})^2 s^{-\beta}}{\mathrm{s}2^{\propto}} + p(x)x\right] + \mathrm{is}^{\propto}\left[\frac{2(-\mathrm{i})S^{\beta}x)}{\mathrm{s}^{\propto}}\right]}{9\mathrm{D}^2 + (\mathrm{is}^{\propto})^2}\right\},$$

$= F^{c^{-1}}\left\{\frac{3S^{-\beta} - 2S^{-\beta}x}{(\mathrm{is}^{\propto})^2[(\frac{3\mathrm{D}}{\mathrm{is}^{\alpha}})^2 + 1]}\right\}$, After simple computations *, we get:*

$v(x,y) = (3-2x)y$.

So , we obtain

$$w = 4y^2 + +i(3-2x)y \; .$$

Conclusion

In this work ,we can use the complex Sadik Transform (CST) to solve the 1^{st}order complex differential equations with constant coefficients by introducing two examples that explain the interest of the complex Sadik integral (CST) of reaching to accurate solution.

References

[1] Saed M Traq , Emad A Kuffi ," the New complex Integral Transform ʻʻ complex Sadik Transform " and It´s Applications , Ibn Al Haitham Journal for pure and Applied science , Vol.(35) , No(3) , (2022).

[2] Emad A .kuffi , Rafid Habib Buti , Zainab Hayder Abid , " Solution of first order Constant Coefficients Complex differential equations by SEE transform method , Journal of Interdisciplinary Mathematics , vol.(3) , NO(6), (2022) .

[3] Emad A. Mansour , Sadiq A .Mehdi , Emad A .kuffi , The new integral Transform and its applications , Int . J. Nonlinear Anakl . Appl . Vol(12) , No(2) , (2022)

[4] Sara Falih Maktoof , Emad kuffi , Elaf Sabah Abbas, " Emad -Sara Transform" a new integral transform , Journal of Interdisciplinary mathematics , Vol(24) , NO(7) , (2021).

[5] Emad A. Mansour , Sadiq A .Mehdi , Emad A .kuffi , " On the complex SEE change and System of partial Differential Equations ", In . J. Nonlinear Anal . Appl.(12) (2021) NO(2) .

[6] Emad A .kuffi , Sara Falih Maktoof , "Emad -Falih transform" a new integral transform ,Journal of Interdisciplinary mathematics , Vol(24) , NO(8) , (2021).

[7] Elaf Sabah Abbas, Emad A .kuffi , Alyaa Albeddmman Jawad, new integral " Kuffi_ Abbas _Jawad " KAJ Transform and Its applications on ordinary differential equations , Journal of Interdisciplinary mathematics , Vol.(25) , NO(5) , (2022).

[8] Intidhar Zamil mushtt , Emad A .kuffi , " Sadik and complex integral Transforms of System of ordinary Differential equation , Iraqi Journal for complex sciences and Mathematics ,Vol.(9) , NO(2) , (2021).

[9] Mohamed Elarabi Benattia , Kacem Belghabb ," Application of_ Aboodh Transform for Solving first order constant coefficients complex Equation , General Letters in Mathematics ,Vol.(6) , NO(1) , (2019).

[10] Eman A. Mansour , Emad A .kuffi ,Sadiq A .Mehdi , The New Integral transform , " SEE Transform" and Its Applications, periodicals of Engineering and Natural Science ,Vol.(9) , NO(2) , (2021).

حل المعادلات التفاضلية المعقدة من الرتبة الأولى باستخدام تقنية تحويل صادق المعقد

شذى حيدر ذياب[1]، عماد عباس كوفي[2]، نور كريم سلمان[3]، إيمان عاجل منصور[4]، أحمد جلال عيسى[5]

[1,2,3] قسم الرياضيات، كلية التربية الأساسية، الجامعة المستنصرية، العراق بغداد.

[4] قسم التقنيات الكهربائية، الجامعة التقنية الجنوبية، المعهد التقني الناصرية، العراق.

[5] قسم الرياضيات، كلية العلوم، جامعة كارابوك، تركيا.

الملخص:

في هذه الورقة، نقدم تحويل صادق التكاملي المعقد لأيجاد الحل الدقيق للمعادلات التفاضلية المعقدة من الرتبة الأولى ذات المعاملات الثابتة. تقدم هذه التقنية استراتيجية عملية وسريعة لحل مجموعة متنوعة من مشاكل المؤثر الخطي.