Websites:
http://www.sciencepub.net
http://www.sciencepub.net/report

Emails:
editor@sciencepub.net
reportopinion@gmail.com

Report and Opinion

MARSLAND PRESS
Multidisciplinary Academic Journal Publisher

Analysis of Electrical Circuits Related To Impulsive Potential Source with Step Function by Elzaki Transform

Updesh Kumar, Govind Raj Naunyal

Associate Professor
Department of Mathematics
KGK (PG) College Moradabad
Dinesh Verma
drdinesh.maths@ gmail.com

Abstract: The impulsive response of network circuits are generally analyzed by adopting different integral transforms. The paper inquires the impulsive response of network circuits by Elzaki integral transform: Elzaki Transform and proves the applicability of Elzaki Transform to get hold of the impulsive response of Electrical circuits.

[Updesh Kumar, Govind Raj Naunyal. **Analysis of Electrical Circuits Related To Impulsive Potential Source with Step Function by Elzaki Transform**. *Rep Opinion* 2022;14(5):1-3]. ISSN 1553-9873 (print); ISSN 2375-7205 (online). http://www.sciencepub.net/report. 1.doi:10.7537/marsroj140522.01.

Keywords: Elzaki Transform, Impulsive Response, Network Circuits.

INTRODUCTION

The Elzaki Transform has been applied in solving initial value problems in most of the science and engineering disciplines. The Elzaki Transform was composed recently by the applied it to analyze initial value problems in science and engineering disciplines [1,2,3,4,5,6,7,8,9,10]. This transform is not broadly known since it is composed recently. The electrical circuits are usually analyzed by adopting different integral transforms or methods [11,12,13,14,15,16,17,18,19,20].In this paper, we present a Elzaki integral analyze the impulsive response of network circuits and reveals that it can also be obtained easily by the application of Elzaki Transform.

DEFINITION

2.1 Elzaki Transform

If the function ɦ(y), y ≥ 0 is having an exponential order and is a piecewise continuous function on any interval, then the Elzaki transform of ɦ(y) is given by

$$E\{ɦ(y)\} = \bar{ɦ}(p) = p\int_0^{\infty} e^{-\frac{y}{p}}\, ɦ(y)dy.$$

The Elzaki Transform [1, 2, 3] of some of the functions are given by

- $E\,\{y^n\} = n!\,p^{n+2}\,, where\; n = 0,1,2,..$
- $E\,\{e^{ay}\} = \frac{p^2}{1-ap}\,,$
- $E\,\{sinay\} = \frac{ap^3}{1+a^2p^2}\,,$
- $E\,\{cosay\} = \frac{ap^2}{1+a^2p^2}\,,$
- $E\,\{sinhay\} = \frac{ap^3}{1-a^2p^2}\,,$
- $E\,\{coshay\} = \frac{ap^2}{1-a^2p^2}\,.$

2.2 Inverse Elzaki Transform

The Inverse Elzaki Transform of some of the functions are given by

- $E^{-1}\{p^n\} = \frac{y^{n-2}}{(n-2)!}\;, n = 2, 3, 4\,...$
- $E^{-1}\{\frac{p^2}{1-ap}\} = e^{ay}$
- $E^{-1}\{\frac{p^3}{1+a^2p^2}\} = \frac{1}{a}\sin ay$
- $E^{-1}\{\frac{p^2}{1+a^2p^2}\} = \frac{1}{a}\cos ay$
- $E^{-1}\{\frac{p^3}{1-a^2p^2}\} = \frac{1}{a}\sin hay$
- $E^{-1}\{\frac{p^2}{1-a^2p^2}\} = \frac{1}{a}\cos hay$

2.3 Elzaki Transform of Derivatives

The Elzaki Transform [1, 2, 3] of some of the Derivatives of h(y) are given by

- $E\{h'(y)\} = \frac{1}{p}E\{h(y)\} - p\,h(0)$

  $or\; E\{ɦ'(y)\} = \frac{1}{p}\bar{ɦ}(p) - p\,ɦ(0),$
- $E\{ɦ''(y)\} = \frac{1}{p^2}\bar{ɦ}(p) - ɦ(0) - pɦ'(0),$

  and so on.

METHODOLOGY

SERIES R-L NETWORK CIRCUIT WITH IMPULSIVE POTENTIAL SOURCE

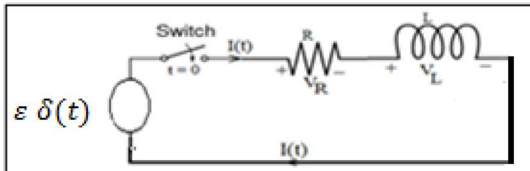

Figure1 : **SERIES R-L NETWORK CIRCUIT WITH IMPULSIVE POTENTIAL SOURCE**

The series R-L network circuit with impulsive potential source [4], [5] is analyzed by the following differential equation

$L\dot{I}(t) + R\,I(t) = \varepsilon\, u(t), \qquad \dot{I} \equiv \frac{d}{dt}$

Or

$\dot{I}(t) + \frac{R}{L} I(t) = \frac{\varepsilon}{L}\, u(t) \ldots .\ (1)$

ε *is the strength of delta potential in volt*

And I (0) = 0.

The Elzaki transform of equation (1) gives

$E\{\dot{I}(t)\} + \frac{R}{L} E\{I(t)\} = \frac{\varepsilon}{L}\{u(t)\}$

$\frac{1}{q}G(q) - qI(0) + \frac{R}{L}G(q) = \frac{\varepsilon}{L}q^2 \ldots .\ (2)$

Put $I(0) = 0$, equation (2) on simplifying gives,

$G(q) = \frac{\varepsilon q^3}{(qR + L)}$

$G(q) = \frac{\varepsilon}{R}\left[q^2 - \frac{q^2}{(1+\frac{R}{L}q)}\right] \ldots .\ (3)$

Taking inverse Elzaki Transform, we get

$I(t) = \frac{\varepsilon}{R}\left[1 - e^{-\frac{R}{L}t}\right] \ldots \ldots\ (4)$

This equation yields the instantaneous current through the series R-L network circuit with an impulsive potential source.

SERIES RC NETWORK CIRCUIT WITH IMPULSIVE POTENTIAL SOURCE

The series R-C network circuit with impulsive potential source [4, 5] is analyzed by the following differential equation

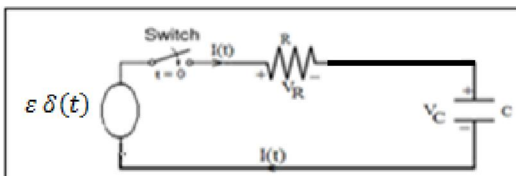

Figure3: **SERIES R-C NETWORK CIRCUIT WITH IMPULSIVE POTENTIAL SOURCE**

$\dot{Q}(t)R + \frac{Q(t)}{C} = \varepsilon\, u(t)$

Or

$\dot{Q}(t) + \frac{1}{RC}Q(t) = \frac{\varepsilon}{R}u(t) \ldots .\ (10)$

Here, Q(t)is the instantaneous charge and Q (0) = 0.

The Elzaki transform of (10) gives

$\frac{1}{q}G(q) - qG(0) + \frac{1}{RC}G(q) = \frac{\varepsilon}{R}q^2$

Put Q (0) = 0 we get

$\frac{1}{q}G(q) + \frac{1}{RC}G(q) = \frac{\varepsilon}{R}q^2$

$G(q) = \frac{\varepsilon q^3 RC}{R(q + RC)}$

$G(q) = \frac{\varepsilon q^3}{R(1+\frac{q}{RC})}$

OR

$G(q) = \varepsilon C\left(q^2 - \frac{q^2}{(1+\frac{q}{RC})}\right) \ldots \ldots .\ (11)$

Taking inverse Elzaki Transform, we get

$Q(t) = \varepsilon C\left[1 - e^{-\frac{1}{RC}t}\right]$

Or

$I(t) = \dot{Q}(t) = \frac{\varepsilon}{R}\left[e^{-\frac{1}{RC}t}\right] \ldots ..\ (12)$

This equation yields the instantaneous charge through the series R-C network circuit with an impulsive potential source.

CONCLUSION

In this paper, we have obtained successfully the impulsive response of network circuits by Elzaki Transform. It is finished that the Elzaki Transform is accomplished in obtaining the impulsive response of the electrical network circuits.

REFRENCES

[1] Dinesh Verma , Elzaki –Laplace Transform of some significant Functions, Academia Arena, Volume-12, Issue-4, April 2020..

[3] Dinesh Verma, Aftab Alam, Analysis of Simultaneous Differential Equations By Elzaki Transform Approach, Science, Technology And Development Volume Ix Issue I January 2020.

[4] Sunil Shrivastava, Introduction of Laplace Transform and Elzaki Transform with Application (Electrical Circuits), International Research Journal of Engineering and Technology (IRJET) ,volume 05 Issue 02 , Feb-2018.

[5] Tarig M. Elzaki, Salih M. Elzaki and Elsayed Elnour, On the new integral transform Elzaki transform fundamental properties investigations and applications, global journal of mathematical sciences: Theory and Practical, v olume 4, number 1(2012).

[6] Dinesh Verma and Rahul Gupta ,Delta Potential Response of Electric Network Circuit, Iconic Research and Engineering Journal (IRE) Volume-3, Issue-8, February 2020.

[7] Dinesh Verma, Elzaki Transform of some significant Infinite Power Series, International Journal of Advance Research and Innovative Ideas in Education (IJARIIE)" Volume-6, Issue-1, February 2020.

[8] Dinesh Verma and Rahul Gupta, Delta Potential Response of Electric Network Circuit, *Iconic Research and Engineering Journal (IRE)*" Volume-3, Issue-8, February 2020.

[9] Rohit Gupta, Dinesh Verma and Amit Pal Singh, Double Laplace Transform Approach to the Electric Transmission Line with Trivial Leakages through electrical insulation to the Ground, Compliance Engineering Journal Volume-10, Issue-12, December 2019.

[10] Rohit Gupta, Rahul Gupta and Dinesh Verma ,Laplace Transform Approach for the Heat Dissipation from an Infinite Fin Surface , Global Journal of Engineering Science and Researches (GJESR),Volume-06, Issue-2(February 2019).

[11] Dinesh Verma , Elzaki transform approach to differentiatial equation with Legureer polynomial, international research journal of modernization in engineering technology and science (IRJMETS), Volume-2, Issue-3, March -2020.

[12] Dinesh Verma, Rohit Gupta, Analysis boundary value problems in physical science via elzaki Transform, ASIO journal of chemistry, physics, Mathematics and applied sciences (ASIO JCPMAS), VOLUME-4 , Issue-1,2020.

[13] Dinesh Verma, Aftab Alam, Dinesh Verma – Laplace Transform of some momentous Function, Advances and Applications in mathematical sciences, Volume 20, Issue 7, may 2021.

[14] Dinesh verma, Rahul gupta, rohit Gupta, determining rate of heat convected from a uniform infinite fin using gupta transform, Roots international journal of multidisplenary researchers,volume 7, issue 3, February 2021.

[15] Dinesh Verma Analytical Solutuion of Differential Equations by Dinesh Verma Tranforms (DVT), ASIO Journal of Chemistry, Physics, Mathematics & Applied Sciences (ASIO-JCPMAS), Volume -4, Issue-1, 2020, PP:24-27.

[16] Dinesh Verma, Empirical Study of Higher Order Diffeential Equations with Variable Coefficient by Dinesh Verma Transformation (DVT), ASIO Journal of Engineering & Technological Perspective Research (ASIO-JETPR), Volume -5, Issue-1, 2020, pp:04-07.

[17] Dinesh Verma, Amit Pal Singh and Sanjay Kumar Verma, Scrutinize of Growth and Decay Problems by Dinesh Verma Tranform (DVT), Iconic Research and Engineering Journals *(IRE Journals)*, Volume-3, Issue-12, June 2020; pp: 148-153.

[18] Dinesh Verma, Elzaki Transform Approach to Differential Equations, *Academia Arena*, Volume-12, Issue-7, 2020, pp: 01-03.

[19] Dinesh Verma and Rohit Gupta, Analyzying Boundary Value Problems in Physical Sciences via Elzaki Transform , by in ASIO Journal of Chemistry, Physics, Mathematics & Applied Sciences (ASIO-JCPMAS), Volume -4, Issue-1, 2020, ISSN: 2455-7064, PP:17-20.

[20] Dinesh Verma, Elzaki Transform Approach to Differential Equatons with Leguerre Polynomial, *International Research Journal of Modernization in Engineering Technology and Science (IRJMETS),* Volume-2, Issue-3, March 2020, pp: 244-248:.

4/12/2022