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An Approach of Electric Circuit Via Dinesh Verma Transform

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Abstract- The electrical network circuits with delta potential are generally solved by adopting Laplace transform method. The paper inquires the electrical network circuits with delta potential by Dinesh Verma transform technique. The purpose of paper is to prove the applicability of Dinesh Verma transform to analyze electrical network circuits with delta potential.

Indexed Terms- Dinesh Verma Transform, Electrical Network Circuit, Delta Potential.

I. INTRODUCTION

The Dinesh Verma Transform (DVT) applied in different areas of science, engineering and technology [1], [2], [3] [4], [5], [6], [7] [8,9,10,11,12,13] The Dinesh Verma Transform (DVT) is implemented in various fields and fruitfully solving linear differential equations. Via Dinesh Verma Transform (DVT) Ordinary linear differential equation with constant coefficient and variable coefficient and simultaneous differential equations can be easily resolved, without finding their complementary solutions. It also comes out to be very effective tool to analyze differential equations [14,15,16,17,18,19,20,21,22,23], Simultaneous differential equations, Integral equations etc. Also Dinesh Verma Transform has been applied in solving boundary value problems in most of the science and engineering disciplines [1]. It also comes out to be very effective tool to analyze the electrical network circuits with delta potential. The general differential equations for analyzing the electrical circuits are generally solved by adopting Elzaki Transform method or Laplace transform method or matrix method or convolution method or calculus method [2, 3, 4, 5, 6, 7, 8, 9, 10, 11,]. In this paper, we present Dinesh Verma transform technique to analyze electrical network circuits with delta potential.

BASICS OF DINESH VERMA TRANSFORM

Dinesh Verma Transform

Let g(y) is a well-defined function of real numbers $y \geq 0$. The Dinesh Verma Transform of g(y), denoted by G(r) or D{g(y)}, is defined as $D\{g(y)\} = r^3 \int_0^\infty e^{-ry} g(y)dy = G(r)$, provided that the integral is convergent, where r may be a real or complex parameter and R is the Dinesh Verma Transform operator.

The Dinesh Verma Transform [1] of some of the functions are given by

- $D\{t^n\} = \frac{n!}{p^{n-4}}$, $where\ n = 0,1,2,..$
- $D\{e^{at}\} = \frac{p^5}{p-a}$,
- $D\{sinat\} = \frac{ap^5}{p^2+a^2}$,
- $D\{cosat\} = \frac{p^6}{p^2+a^2}$,
- $D\{sinhat\} = \frac{ap^5}{p^2-a^2}$,
- $D\{coshat\} = \frac{p^6}{p^2-a^2}$.
- $D\{\delta(t)\} = p^5$

Inverse Dinesh Verma Transform

The Inverse Dinesh Verma Transform [1] of some of the functions are given by

- $D^{-1}\left\{\frac{1}{p^{n-4}}\right\} = \frac{t^n}{n!}$, $where\ n = 0,1,2,..$
- $D^{-1}\left\{\frac{p^5}{p-a}\right\} = e^{at}$,
- $D^{-1}\left\{\frac{p^5}{p^2+a^2}\right\} = \frac{sinat}{a}$,
- $D^{-1}\left\{\frac{p^6}{p^2+a^2}\right\} = cosat$,
- $D^{-1}\left\{\frac{p^5}{p^2-a^2}\right\} = \frac{sinhat}{a}$,
- $D^{-1}\left\{\frac{p^6}{p^2-a^2}\right\} = coshat$,
- $D^{-1}\{p^5\} = \delta(t)$

Dinesh Verma Transform of Derivatives
The Dinesh Verma Transform [1] of some of the Derivatives of h(y) are given by

$D\{f'(t)\} = p\bar{f}(p) - p^5 f(0)$
$D\{f''(t)\} = p^2\bar{f}(p) - p^6 f(0) - p^5 f'(0)$
$D\{f'''(y)\} = p^3\bar{f}(p) - p^7 f(0) - p^6 f'(0) - p^5 f''(0)$ And so on.
$D\{tf(t)\} = \frac{5}{p}\bar{f}(p) - \frac{d\bar{f}(p)}{dp}$,
$D\{tf'(\mathrm{t})\} = \frac{5}{p}\left[p\bar{f}(p) - p^5\mathrm{f}(0)\right] - \frac{d}{dp}\left[p\bar{f}(p) - p^5\mathrm{f}(0)\right]$ and
$D\{tf''(\mathrm{t})\} = \frac{5}{p}[p^2\bar{x}(p) - p^6 x(0) - p^5 x'(0)] - \frac{d}{dp}[p^2\bar{x}(p) - p^6 x(0) - p^5 x'(0)]$ And so on.

- RL CCIRCUIT WITH DELTA POTENTIAL OF UNIT STRENGTH

$L\ddot{Q} + R\dot{Q} + \frac{Q}{C} = 33\delta(t)$
$WhereL = 1\ \mathrm{h}enry, R = 6\ ohm,\ C = \frac{1}{9}\ farad$,
$andQ(0) = Q^{'}(0) = 0$
$\ddot{Q} + 6\dot{Q} + 9Q = \delta(t)$
Applying Dinesh Verma Transform, we have

$D\{\ddot{Q}\} + 6D\{\dot{Q}\} + 9D\{Q\} = 33p^5$
or

$p^2\bar{Q}(p) - p^6 Q(0) - p^5 Q^{'}(0) + 6p\ \bar{Q}(p)$
$-6p^5 Q(0) + 9\bar{Q}(p) = 33p^5$
or

$p^2\bar{Q}(p) + 6p\bar{Q}(p) + 9\bar{Q}(p) = 33p^5$
or
$\bar{Q}(p) = \frac{33p^5}{(9+6p+p^2)}$
or
$\bar{Q}(p) = \frac{33p^5}{(3+p)^2}$
Hence
$Q = D^{-1}\left\{\frac{33p^5}{(3+p)^2}\right\}$
or
$Q = 33\ te^{-3t}$

- RLC IRCUIT WITH DELTA POTENTIAL OF UNIT STRENGTH

$L\ddot{Q} + R\dot{Q} = 51\delta(t)$
$WhereL = 1\ \mathrm{h}enry, R = 6\ \mathrm{ohm}$
$andQ(0) = Q^{'}(0) = 0$

$\ddot{Q} + 6\dot{Q} = 51\delta(t)$
Applying Dinesh Verma Transform, we have

$D\{\ddot{Q}\} + 6D\{\dot{Q}\} = 51p^5$
or

$p^2\bar{Q}(p) - p^6 Q(0) - p^5 Q^{'}(0) + 6p\ \bar{Q}(p)$
$-6p^5 Q(0) = 51p^5$
or

$p^2\bar{Q}(p) + 6p\bar{Q}(p) = 51p^5$
or

$\bar{Q}(p) = \frac{51p^5}{(6p+p^2)}$
or
$\bar{Q}(p) = 51\{\frac{p^4}{6} - \frac{p^5}{6(6+p)}\}$
Hence
$Q = 51D^{-1}\{\frac{p^4}{6} - \frac{p^5}{6(6+p)}\}$
or
$Q = \frac{51}{6}[1 - e^{-6t}]$

- RC CIRCUIT WITH DELTA POTENTIAL OF UNIT STRENGTH

$R\dot{Q} + \frac{Q}{C} = 19\delta(t)$
$WhereR = 6\ ohm, C = \frac{1}{9}\ farad$,
$andQ(0) = 0$

$6\dot{Q} + 9Q = 19\delta(t)$
Applying Dinesh Verma Transform, we have
$6D\{\dot{Q}\} + 9D\{Q\} = 19p^5$
or
$6p\bar{Q}(p)$
$-6p^6 Q(0) + 9\bar{Q}(p) = 19p^5$
or

$6p\bar{Q}(p) + 9\bar{Q}(p) = 19p^5$
or
$\bar{Q}(p) = \frac{19p^5}{(9+6p)}$
or

$\bar{Q}(p) = \frac{19p^5}{6(\frac{3}{2}+p)}$

Hence

$Q = D\left\{\frac{19p^5}{6(\frac{3}{2}+p)}\right\}$

or

$Q = \frac{19}{6}e^{-1.5t}$

$81\ddot{y} + 36y = 121\delta(t)$

$and\ y(0) = 0\ , y'(0) = 2$

Applying Dinesh Verma Transform, we have

$81\text{D}\ \{\ddot{y}\} + 36D\{y\} = 121p^5$

Or

$81p^2\bar{y}(p) - 81p^6y(0) - 81p^5y'(0) + 36\bar{y}(p) = 121p^5$

Or

$81p^2\bar{y}(p) - 162p^5 + 36\bar{y}(p) = 121p^5$

Or

$\bar{y}(p) = \frac{283p^5}{36+81p^2}$

Hence

$y = \frac{283}{54}\ D^{-1}\left\{\frac{\frac{6}{9}p^5}{\frac{36}{81}+p^2}\right\}$

or

$y = \frac{283}{54}sin\frac{6}{9}t$

CONCLUSION

In this paper, we have analyzed the electrical network circuits with delta potential by Dinesh Verma Transform technique**.** It may be finished that the technique is accomplished in analyzing the electrical network circuits with delta potential.

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