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ANALYZATION OF PHYSICAL SCIENCES PROBLEMS

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ABSTRACT
Most of the issues in physical sciences area unit usually solved by adopting calculus methodology or Laplace transformation methodology or matrix methodology or convolution methodology. The paper inquires some issues in physical sciences via Dinesh Verma rework methodology. the aim of paper is to prove the pertinency of Dinesh Verma Transformation to research the issues in physical sciences.
KEYWORDS: ***DVT Transform, Problems in Physical Sciences.***

INTRODUCTION

The Dinesh Verma Transform (DVT) has been applied in different areas of science, engineering and technology [1], [2], [3] [4], [5], [6], [7]. The Dinesh Verma Transform (DVT) is applicable in different fields and successfully 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, Simultaneous differential equations, Integral equations etc.

BASIC DEFINITIONS

DEFINITION OF DINESH VERMA TRANSFORM (DVT)

Dr. Dinesh Verma recently introduced a completely unique remodel and named it as Dinesh Verma remodel (DVT). Let f(t) may be a well-defined perform of real numbers t ≥ zero. The Dinesh Verma remodel (DVT) of f(t), denoted by D, is outlined as

$$D\{\{\mathrm{f(t)}\} = p^5 \int_0^\infty e^{-pt} f(t)dt = \bar{f}(p)$$

provided that the integral is focused, wherever p may be a true or complicated parameter and D is that the Dinesh Verma remodel (DVT) operator.

DINESH VERMA TRANSFORM OF ELEMENTARY FUNCTIONS

According to the definition of Dinesh Verma transform (DVT),

$$\mathrm{D}\{t^n\} = p^5 \int_0^\infty e^{-pt}\, t^n dt$$

$$= p^5 \int_0^\infty e^{-z} \left(\frac{z}{p}\right)^n \frac{dz}{p} \quad, z = pt$$

$$= \frac{p^5}{p^{n+1}} \int_0^\infty e^{-z} (z)^n dz$$

Applying the definition of gamma function,

$$\mathrm{D}\,\{y^n\} = \frac{p^5}{p^{n+1}} \Gamma(n+1)$$

$$= \frac{1}{p^{n-4}} n!$$

$$= \frac{n!}{p^{n-4}}$$

Hence, $D\{t^n\} = \frac{n!}{p^{n-4}}$

Dinesh Verma Transform (DVT) of some elementary Functions

- $D\{t^n\} = \frac{n!}{p^{n-4}}$, $where\ n = 0,1,2,..$

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

- **T**he Inverse Dinesh Verma Transform (DVT) of some of the functions are given by
- $D^{-1}\left\{\frac{1}{p^{n-4}}\right\} = \frac{t^n}{n!}$, $where\ n = 0,1,2,..$
- $D^{-1}\left\{\frac{p^5}{p-a}\right\} = e^{at}$,
- $D^{-1}\left\{\frac{p^5}{p^2+a^2}\right\} = \frac{sinat}{a}$,
- $D^{-1}\left\{\frac{p^6}{p^2+a^2}\right\} = cosat$,
- $D^{-1}\left\{\frac{p^5}{p^2-a^2}\right\} = \frac{sinhat}{a}$,
- $D^{-1}\left\{\frac{p^6}{p^2-a^2}\right\} = coshat$,
- $D^{-1}\{p^4\} = \delta(t)$

DINESH VERMA TRANSFORM (DVT) OF DERIVATIVES

$$D\{f'(t)\} = p\bar{f}(p) - p^5 f(0)$$

$$D\{f''(t)\} = p^2\bar{f}(p) - p^6 f(0) - p^5 f'(0)$$

$$D\{f'''(y)\} = p^3\bar{f}(p) - p^7 f(0) - p^6 f'(0) - p^5 f''(0)$$ 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

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

MATERIAL AND METHOD

MODULE I:

The rate at which a body cools is proportional to the difference between the temperature of the body and that of the surrounding air. The temperature T of the body at any instant is given by the differential equation (assuming that in air at 25 degree Celsius will cool from 100 to 75 degree Celsius in one minute)

$$\dot{T} - kT = -25k$$

Applying DineshVerma Transform, we have

$$p\bar{T}(p) - p^5 T(0) - k\bar{T}(p) = -25kp^4$$

Put T (0) = 100 and rearranging, we get

$$\bar{T}(p) = \frac{-25kp^4}{(p-k)} + \frac{100p^5}{(p-k)}$$

Hence

$$T = D^{-1}\left\{\frac{-25kp^4}{(p-k)} + \frac{100p^5}{(p-k)}\right\}$$

Applying inverse DVT and solving, we have

$T = 25 + 75e^{kt}$

MODULE II:

The rate at which the ice melts is proportional to the amount of ice at the instant. If M is the amount of ice initially, the amount m of ice at any time t is given by the differential equation

$$\dot{m} - km = 0$$

Applying Dinesh Verma Transform, we have

$$p\bar{m}(p) - p^5 m(0) - k\bar{m}(p) = 0$$

Put m(0) = M and rearranging, we have

$$\bar{m}(p) = \frac{Mp^5}{(p-k)}$$

Hence

$$m = D^{-1}\left\{\frac{Mp^5}{(p-k)}\right\}$$

Applying inverse DVT and solving, we have

$m = Me^{kt}$

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MODULE III:

Under certain conditions cane sugar is converted into dextrose at a rate, which is proportional to the amount unconverted at any time. If M is the amount of cane sugar initially and the amount m of the cane sugar converted into dextrose is given by the differential equation

$$\dot{m} + km = kM$$

Applying Dinesh Verma Transform, we have

$$p\overline{m}(p) - p^5 m(0) - k\overline{m}(p) = kMp^4$$

Put m(0) = 0 and rearranging, we have

$$\overline{m}(p) = \frac{Mkp^4}{(p-k)}$$

Hence

$$m = D^{-1}\left\{\frac{Mkp^3}{(1+kp)}\right\}$$

Applying inverse DVT and solving, we have

$m = M[1 - e^{-kt}]$

MODULE IV

The rate of increase of the population is proportional to the number of inhabitants. If N is the population initially, the population n of the country at any time is given the differential equation

$$\dot{n} - kn = 0$$

Applying Dinesh Verma Transform, we have

$$p\bar{n}(p) - p^5 n(0) - k\bar{n}(p) = 0$$

Put n(0) = N and rearranging, we have

$$\bar{n}(p) = \frac{Np^5}{(p-k)}$$

Hence

$$n = D^{-1}\left\{\frac{Np^2}{(1-kp)}\right\}$$

Applying inverse DVT and solving, we have

$n = Ne^{kt}$

MODULE V

A particle is projected with velocity u making an angle α with the horizontal. Neglecting air resistance, the differential equations of the motion are

$$\ddot{x} = 0 \ldots (1)$$

$$\ddot{y} + g = 0 \ldots (2)$$

Applying Dinesh Verma Transform of (1), we have

$$\text{D}\,\{\ddot{x}\} = 0$$

or

$$p^2\bar{x}(p) - p^6 x(0) - p^5 x'(0) = 0$$

Put $x(0) = 0, x'(0) = u\,cos\alpha$ and rearranging, we have

$$\bar{x}(p) = p^3\,u\,cos\boldsymbol{\alpha}$$

Hence

$$x = D^{-1}\{p^3\,u\,cos\boldsymbol{\alpha}\}$$

Applying inverse DVT and solving, we have

$$x = (u\,cos\alpha)\,t$$

Applying Dinesh Verma Transform of (2), we have

$$\text{D}\,\{\ddot{y} + g\} = 0$$

or

$$p^2\bar{y}(p) - p^6 y(0) - p^5 y'(0) + gp^4 = 0$$

Put $y(0) = 0, y'(0) = u\,sin\alpha$ and rearranging, we have

$$\bar{y}(p) = p^3\,u\,sin\boldsymbol{\alpha} - \boldsymbol{g}p^2$$

Hence

$$y = D^{-1}\{p^3\,u\,sin\boldsymbol{\alpha} - \boldsymbol{g}p^2\}$$

Applying inverse DVT and solving, we have

$y = (u\,sin\boldsymbol{\alpha})\boldsymbol{t} - \boldsymbol{g}t^2/2$

MODULE VI

A particle moving in a plane is subjected to a force directed towards a fixed point O (origin) and proportional to the distance of the particle from O. The differential equations of the motion are

$$\ddot{x} + k^2 x = 0 \ldots (1)$$

$$\ddot{y} + k^2 y = 0 \ldots (2)$$

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Applying Dinesh Verma Transform of (1), we have

$$D\{\ddot{x} + k^2 x\} = 0$$

or

$$p^2\bar{x}(p) - p^6 x(0) - p^5 x'(0) + k^2\bar{x}(p) = 0$$

Put $x(0) = 1, x'(0) = 0$ and rearranging, we have

$$\bar{x}(p) = \frac{p^6}{k^2+p^2}$$

$Hence$

$$x = D^{-1}\left\{\frac{p^6}{k^2+p^2}\right\}$$

Applying inverse DVT and solving, we have

$$x = coskt$$

Applying Dinesh Verma Transform of (2), we have

$$D\{\ddot{y} + k^2 y\} = 0$$

or

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

Put $y(0) = 0, y'(0) = 2$ and rearranging, we have

$$\bar{y}(p) = \frac{2p^5}{k^2+p^2}$$

$Hence$

$$x = D^{-1}\left\{\frac{2p^5}{k^2+p^2}\right\}$$

Applying inverse DVT and solving, we have

$$x = (2/k)\, sinkt$$

CONCLUSION

In this paper, we have analyzed the problems in physical sciences by Dinesh Verma Transform method**.** It may be finished that the method is accomplished in analyzing the problems in physical sciences.

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