Application of mathematical equations

Mohammad Mahbod

mohammad.mahbod44@gmailcom, Isfahan Medical Science University Technical Office, Isfahan Medical Science University

Application of mathematical equations Vol. 9 No. 9 Page 3072 Journal of Advances in Mathematics and www.P3M.ir , has been printed for the application of the 1st order differential equations in space (oxyz).

For the application of mathematical equations, variable axis (x) can be assumed to equal time axis (T). That is by assuming variable axis (x=t) to equal time axis (x), the mathematical equation is converted to a movement equation. With the equality of the above mentioned relation, it can be concluded that all the mathematical equation coordinates f(x, y, z, c1) =0 will equal all the movement equation coordinates f (t, y, z, c1) =0

Example 1: Apply the opposite mathematical equation and specify speed equations (Vx, Vy, and Vz) on 3 axes of coordinates:

$x.y^2+x.z^3+y^3.z+c_1=0$

For the application of the above mentioned mathematical equation, it will suffice to have (x=t).

That is: $t.y^2+t.z^3+y^3.z+c_1=0$

$x=t \Rightarrow dx=dt \Rightarrow \frac{dx}{dt} = 1 = Vx$

Now, in order to calculate (Vy, Vz) it is enough to integrate the above (dynamic) movement equation from (z and y) relative to (t). That is:

$2.t.y.dy+y^2.dt+z^3dt+3.z^2.t.dz+3.y^2.zdy+y^3.dz=0$

The above mentioned relation is divided by (dt).

$2.t.y.\frac{dy}{dt} +y^2+z^3+3z^2.t.\frac{dz}{dt}+3.y^2.z.\frac{dy}{dt} +y^3.\frac{dz}{dt} = 0$

$\frac{dy}{dt} = Vy \quad , \quad \frac{dz}{dt} = Vz$

$2.t.y.Vy+y^2+z^3+3z^2.t.Vz +3.y^2.z.Vy +y^3.Vz = 0$

$$\mathbf{Vt=\sqrt{Vx^2 + Vy^2 + Vz^2} = \sqrt{1 + V^2y + V^2z}}$$

$$\mathbf{0 < Vt \leq 300{,}000\ Km/Sec}$$

The relation thus obtained is the same relation for the application of the 1st order differential equations in space (oxyz), printed in periodical 9 No 9 Page 3072 Journal of Advances in Mathematics.

The only difference between the above mentioned relation and the differential equations relation is that Vx=1, and if the moving object or space ship has the constant speed of (Vx=c) instead of the constant number of (Vx=1) on the (x) axis, we will have:

$$\mathbf{Vt=\sqrt{c^2 + c^2.V^2y + c.V^2z} = c.\sqrt{(1 + V^2y + V^2z)}}$$

$$\mathbf{0 < Vt \leq 300{,}000\ Km/Sec}$$

Proof:

$$\left.\begin{aligned} y' &= \frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{Vy}{Vx} = \frac{Vy}{1} = \frac{c.Vy}{c} \\ z' &= \frac{dz}{dx} = \frac{dz/dt}{dx/dt} = \frac{Vz}{Vx} = \frac{Vz}{1} = \frac{c.Vz}{c} \end{aligned}\right\} = 0$$

Dimensions (Vx,Vy,Vz) depend on dimension (x,y,z,t). If distances dimension is in centimeters and dimension (t) is time in seconds, speed dimensions will be (cm/sec), and if distances dimension is in meters and dimension (t) is time in seconds, (m/sec) shall apply.

A very important point: In the application of mathematical equations, much care should be taken that there are …. In mathematical equations:
A: open curves.
B: closed curves.

A: The application of mathematical equations in the open curve sector is the same example mentioned above.

B: In mathematical equations, care should be taken that a mathematical equation shall not be of the closed curve type, for it does not apply to closed curves such as a circle an ellipse, a sphere, oscillations reciprocal movements.
It is reminded again that closed curve mathematical equations shall not be used in any situation. They have no answers and it is absolutely advised not to use them. In continuation, the general concept will be specified using some examples.

Example: The opposite mathematical equation is circle equation ($x^2 + y^2 = R^2$) of the closed curve type. This equation cannot thus be applied in the form of (x=t).

Proof: If a moving object moves on the above mentioned circle at a constant linear speed, its images on the 2 axes (ox) and (oy) will not be fixed, and will be instead in the reciprocal from on the 2 axes (x=R. sin Wt)

In closed curves, moving images will thus always be in the reciprocating form and speed will be variable not constant.
Not in any case, conditions (A) in (B) can thus be used. Now will it be acceptable

A: Open curves: Mathematical equations of the open curves type can be divided in to 3 groups:

A1: Group 1 includes equations which are ($\frac{dx}{dt} = Vx = 1$) and ($y' = \frac{dy}{dt} = Vy$) and($z' = \frac{dz}{dt} = Vy$).
In this group, all the mathematical equation coordinates will equal all the dynamic equation coordinates.

A2: Group 2 includes equations in which speed on the (ox) axis , $Vx=c_1$ equals constant speed (c_1).
In this case, speed on the (oy) axis will equal (c.Vy) and speed on the (oz) axis will equal (c.Vz).
In comparison therefore 2 mathematical and dynamic equations will equal in terms of power and degree of variables. They will however differ in terms of constant coefficients.
It is noteworthy that in groups A_1 And A_2 The image of the moving object speed on the (ox) axis is constant.

A3: If the image of the moving object speed on the (ox) axis is not constant and speed is variable and a function of time Vx=f '(t) The image of the moving object on the (oy) and (oz) axes should be Vy.f ' (t) And Vz.f '(t)
Respectively.

$$\left.\begin{aligned}\frac{dy}{dt} &= Vy.f'(t)\\ \frac{dx}{dt} &= Vx = f'(t)\end{aligned}\right\} \Rightarrow \frac{Vy.f'(t)}{f'(t)} = \frac{Vy}{1}$$

$$\left.\begin{aligned}\frac{dz}{dt} &= Vz.f'(t)\\ \frac{dx}{dt} &= Vx = f'(t)\end{aligned}\right\} \Rightarrow \frac{Vz.f'(t)}{f'(t)} = Vz$$

That is the difference between the 3rd (A3) and 2 groups of (A1 And A2) is that in the 3rd group (A3), speed on the (ox) axis is variable and a function of parameter (t) and in the 2 groups of (A1 and A2), speed on the (ox) axis is constant. Therefore, in the 1st 2 groups of (A1 and A2) acceleration on the (ox) axis equals zero. Yet in the 3rd group of (A3) acceleration on the (ox) axis will not equal zero.

Example: Apply the following mathematical equation based on groups (A1 , A2 , A3).

$Y=A.x^3 + B.x^2 + c.x + D \Rightarrow x=t \Rightarrow dx = dt \Rightarrow \frac{dx}{dt} = Vx = 1$

A1)$\Rightarrow$ $y=A.t^3 + B.t^2 + C.t + D$

$dy = 3A . t^2.dt + 2.B.t.dt+C \Rightarrow \frac{dy}{dt}=3.A.t^2 + 2.B.t + C.t$

$\frac{dy}{dt} = Vy = 3.A.t^2 + 2.B.t + zc.t$

In the relation between the above mentioned mathematical equation and dynamic equation, it is observed that both equations are of the open curve type and lie in group (A_1), with all the coordinates of both equations being equal.

$$\begin{cases} Vx = 1 \\ Vy = 3.A.t^2 + 2.B.t + C.t \end{cases}$$

Now apply the above mentioned mathematical equation based on $Vx=c_1$ and based on group (A2).

$x =c_1.t \Rightarrow \frac{dx}{dt}=Vx = c_1$

A2)$\Rightarrow$ $y=A.(c_1 .t)^3 + B (c1.t)^2 + C(x1.t) +D$

$\frac{dy}{dt} = Vy = A.c^3{}_1.t^3 + B.c^2{}_1.t^2 + c.c_1.t + D.$

In the relation between the above mentioned mathematical equation and dynamic equation, it is observed that both equations lie in group (A2) and are equal in terms of variables. They are however different in terms of constant coefficients.

Now, we shall apply the above mentioned mathematical equation based on Vx=f '(t) , Vy=f '(t) , Vz=f '(t) , ie , the 3rd group (A3).

$$\begin{cases} x = f(t) \\ y = A[f(t)]^3 + b[f(t)]^2 + C.[f(t)] + D \end{cases}$$

$$\text{A3)}\Rightarrow\begin{Bmatrix} Vx = f'(t) \\ Vy.\ f'(t) \\ Vz.\ f'(t) \end{Bmatrix} \Rightarrow dy = 3.A.[f(t)]^2.f'(t).dt + 2.B.[f(t)]^2.f'(t).dt + C.[f'(t)].dt$$

$$\frac{dy}{dt} = Vy = 3.A.[f(t)]^2.f'(t).dt + 2.B.[f(t)]^2.f'(t).dt + C.[f'(t)].dt$$

Using an example, we will clarify the relation between the mathematical equation and the dynamic equation make an example : f'(t)=t .
Given :

$$\left.\begin{matrix} \frac{dx}{dt} = vx = f'(t) = t \Rightarrow f(t) = \frac{1}{2}t^2 + c_2 \\ Vy.f'(t) = Vy.t \\ Vz.f'(t) = Vz.t \end{matrix}\right\} \Rightarrow \begin{cases} \frac{Vy}{Vx} = \frac{Vy.t}{Vx.t} = \frac{dy/dt}{dx/dt} = \frac{dy}{dx} \\ \frac{Vz}{Vx} = \frac{Vz.t}{Vx.t} = \frac{dz/dt}{dx/dt} = \frac{dz}{dt} \end{cases}$$

$$\frac{dx}{dt} = t \Rightarrow dx = t.dt \Rightarrow x = \frac{1}{2}.t^2 + c_2 \Rightarrow x = f(t) = \frac{1}{2}t^2 + c_2$$

$$y = A\left[\frac{1}{2}t^2 + c_2\right]^3 + B\left[\frac{1}{2}t^2 + c_2\right]^2 + C\left[\frac{1}{2}t^2 + c_2\right] + D$$

In this case, we applied the above mentioned equation in group (A3), and it is observed that in group (A3), it enjoys 3 properties:

1. Axis (ox) has acceleration.
   $x = f(t) \Rightarrow \frac{dx}{dt} = f'(t) = t \Rightarrow \frac{d^2x}{dt^2} = f''(t) = 1$
2. Axis (ox) has linear speed.
   Vx=(t)
3. The power of the dynamic equation has changed and increased compared with that of the mathematical equation. Constant coefficients have also changed.

$y=\frac{x+A}{1+x^2}$

$$\text{I.}\begin{cases} x = t \Rightarrow dx = dt \Rightarrow \frac{dx}{dt} = Vx = 1 \\ y = \frac{t+a}{1+t^2} \Rightarrow dy = \frac{(1+t^2).dt-2.t(t+a).dt}{(1+t^2)^2} \\ dy/dt = Vy = \frac{(1+t^2)-2t.(t+a)}{(1+t^2)^2} \end{cases}$$

$$\text{II.}\begin{cases} x = c.t \Rightarrow dx = c.dt \Rightarrow \frac{dx}{dt} = c = Vx \\ y = \frac{c.t+a}{1+(c.t)^2} = \frac{c.t+a}{1+c^2.t^2} \\ dy = \frac{c.(1+c^2.t^2).dt-2.c^2.t(c.t+a).dt}{(1+c^2.t^2)} \\ dy/dt = Vy = \frac{c(1+c^2.t^2)-2.c^2.t(c.t+a)}{(1+c^2.t^2)^2} \end{cases}$$

$$\text{III.}\begin{cases} x = f(t) \Rightarrow dx = f'(t).dt \Rightarrow \frac{dx}{dt} = f'(t) \\ \begin{pmatrix} \frac{d^2x}{dt^2} = f''(t) = \gamma x \;\; \text{Acceleration of the axis (ox)} \\ \frac{d^2y}{dt^2} = \gamma x \qquad \text{Acceleration of the axis (oy)} \end{pmatrix} \\ \left.\begin{matrix} \frac{dy}{dt} = y' = Vy \\ \frac{dx}{dt} = Vx \end{matrix}\right\} \Rightarrow y' = \frac{dy/dt}{dx/dt} = \frac{f'(t).Vy}{f'(t).Vx} = \frac{Vy}{Vx} = Vy = Vx = 1 \\ y = \frac{f(t)+a}{1+[f(t)]^2} \\ \frac{dy}{dt} = Vy = \frac{f'(t).\{1+[f(t)]^2\}-[2.f'(t).f(t)].[f(t)+a]}{\{1+[f(t)]^2\}^2} \end{cases}$$

$$y^2.e^x + 2.y.e^{2.x}=c$$

$$\text{I.}\begin{cases} x = t \Rightarrow dx = dt \Rightarrow \frac{dx}{dt} = Vx = 1 \\ y^2.e^t + 2.y.e^{2.t} = c \;\Rightarrow 2.y.dy.e^t + e^t.dt.y^2 + 2.dy.e^{2.t} + 4.y.e^{2.t}.dt = 0 \\ dy/dt = Vy = \frac{-e^t.y^2-4.y.e^{2.t}}{2.y.e^t+2.e^{2.t}} \end{cases}$$

$$\text{II.}\begin{cases} x = c.t \Rightarrow dx = c.dt \Rightarrow \frac{dx}{dt} = Vx = c \\ y^2.e^{c.t} + 2.y.e^{2.c.t} = c \;\Rightarrow 2.y.dy.e^{c.t} + e^{c.t}.dt.y^2 + 2.dy.e^{2.t} + 4.y.e^{2.c.t} + 4.y.e^{2.c.t}.dt = 0 \\ dy/dt = Vy = \frac{-e^{c.t}.y^2-4.y.e^{2.c.t}}{2.y.e^{c.t}+2.e^{2.c.t}} \end{cases}$$

$$\text{III.}\begin{cases} x = f(t) \Rightarrow dx = f'(t).dt \;\Rightarrow \frac{dx}{dt} = f'(t) \quad \frac{d^2x}{dt^2} = f''(t) = \gamma x \\ d^2y/dt^2 = \gamma y \\ dy/dt = Vy = \frac{-e^{f(t)}.y^2-4.y.e^{2.f(t)}}{2.y.e^{f(t)}+2.e^{2.f(t)}}.f'(t) \end{cases}$$

$$2.x.y + x^2.y^2 - x^2 = c_1$$

I.
$$\begin{cases} x = t \Rightarrow dx = dt \Rightarrow \frac{dx}{dt} = Vx = 1 \\ 2.t.y + t^2.y^2 - t^2 = c_1 \Rightarrow 2.t.dy + 2.y.dt + 2.t^2.y.dy + 2.t.y^2.dt - 2.t.dt = 0 \\ {}^{dy}/_{dt} = Vy = \frac{-2y-2t.y^2+2t}{2.t+2.t^2.y} \end{cases}$$

II.
$$\begin{cases} x = c.t \Rightarrow dx = c.dt \Rightarrow \frac{dx}{dt} = Vx = c \\ 2.c.t.y + (c.t)^2.y^2 - (c.t)^2 = c_1 \\ 2.c.t.dy + 2.c.y.dt + 2.c^2.dt.t.y^2 + 2.y.dy.(c.t)^2 - 2.c^2.t.dt = 0 \\ {}^{dy}/_{dt} = Vy = \frac{-2.c.y-2c^2+2c^2.t}{2.c.t-2.y.c^2.t^2} \end{cases}$$

III.
$$\begin{cases} x = f(t) \Rightarrow dx = f'(t).dt \Rightarrow \frac{dx}{dt} = f'(t) \qquad \frac{d^2x}{dt^2} = f''(t) = \gamma x \\ {}^{d^2y}/_{dt^2} = \gamma y \\ 2.f(t).y + [f(t)]^2.y^2 - [f(t)] = c_1 \\ 2.f'(t).y.dt + 2.f(t).dy + 2.[f'(t)].[f(t)].y^2.dt + 2y.dy.[f(t)]^2 - 2.[f'(t)].[f(t)].dt = 0 \\ {}^{dy}/_{dt} = Vy = \frac{-2.f'(t).y-2.\left[f'(t)\right].[f(t)].y^2+2.\left[f'(t)\right].[f(t)]}{2.f(t)+2.y.[f(t)]^2} \end{cases}$$