The creation of animated actions by means of mathematical model for the Technological process.

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Abstract

With the aid 3d Max software and Max Script language created animation for linear, trigonometric, integral, differential equations and for their systems. Thus the set of 3d Max, Max Script with mathematical equations will facilitate the creation of animated action applied mechanics, equipment and processes using mathematical models.

Keywords

Animated model; graph algorithm; Max Script software; the object motion; the description of the technological process; integral- differential mathematical model; Max Script; 3ds Max.

1. Introduction

Any animated motion can be described by the mathematical formula. Animated action is given in the form of an equation Y = F (X), where the function F (X) may be linear, not linear, e.g.… trigonometric, and more can be defined integral-differential equations. [1].

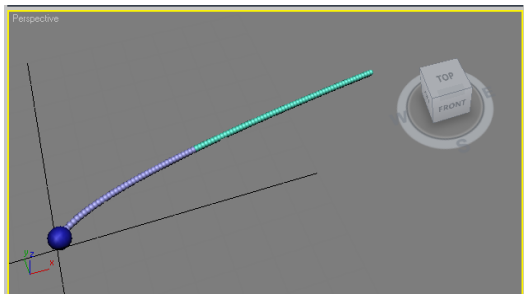
Using Max Script program allows to portray motion of a point on the given coordinates. This limits the ability to create a visual model of the object as the coordinates of the movement is changing by every change parameter of the mathematical model. To solve this problem will require the creation of special programs in Max Script.[1],[2],[3],[4].

The aim of the process is to show the possibilities about Max Script to create animated motion by the construction of an appropriate program, which allows to calculate the coordinates of the object.

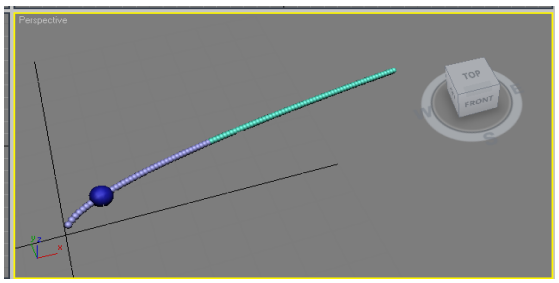
1. The creation of a linear movement using Max Script.

The code is written in Max Script:

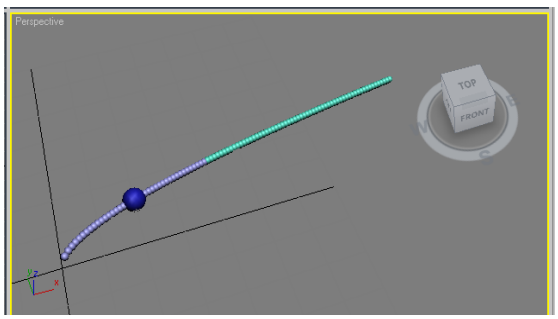
```
a=sphere radius:3
fori=1 to 100 do(
y=3*sqrt(i);
sphere radius:1 pos:[i,y,0]
at time i animate on(a.pos=[i,y,0]
a.rotation.z_rotation=random 0.0 120.0
a.rotation.x_rotation=random 0.0 120.0
a.rotation.y_rotation=random 0.0 120.0))
```



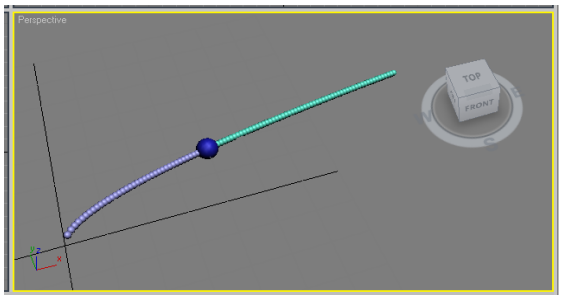
casei = 1



case i = 10



casei = 20



case i = 40

Fig. 1.Presents a set of 3d Max, Max Scrip with the linear equation

The objects moving at i = 1-40 according to the schedule defined parabolic function y = 3 * i ^ 1/2 .

2. The creation of animated actions on the basis of trigonometric equations.

The movement of the object along the line based on the graph of the function Sin (x) shown in **Figure2.**

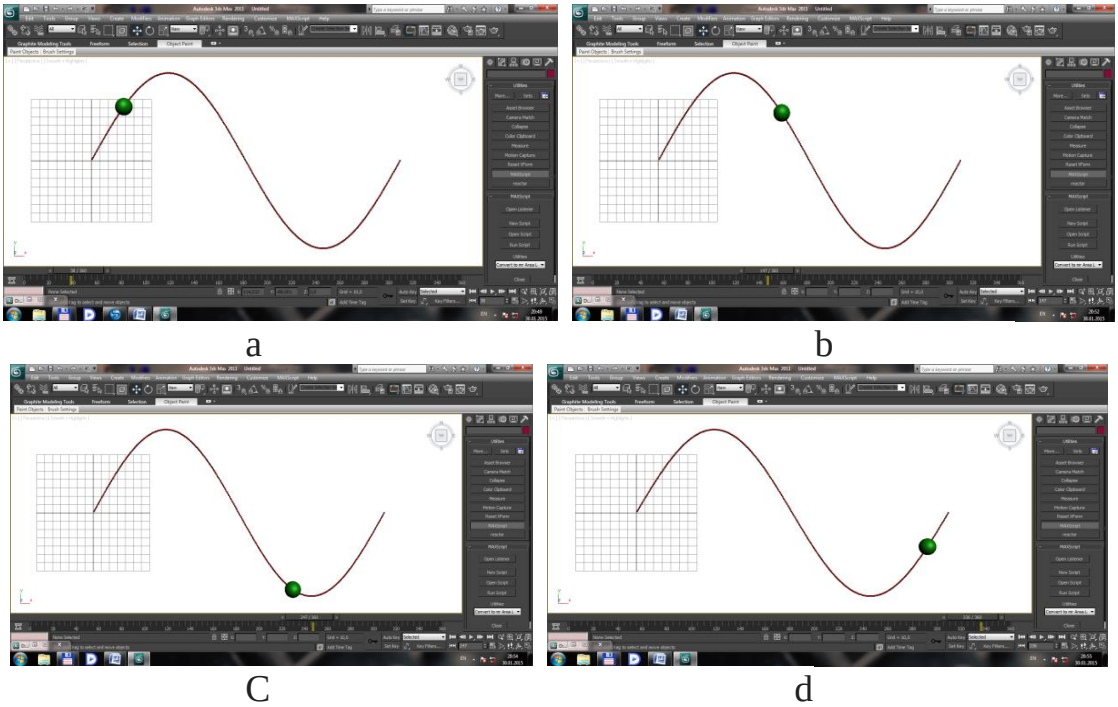


Fig. 2. Presents a set of 3d Max, Max Script with trigonometric equation.

The code is written in Max Script:

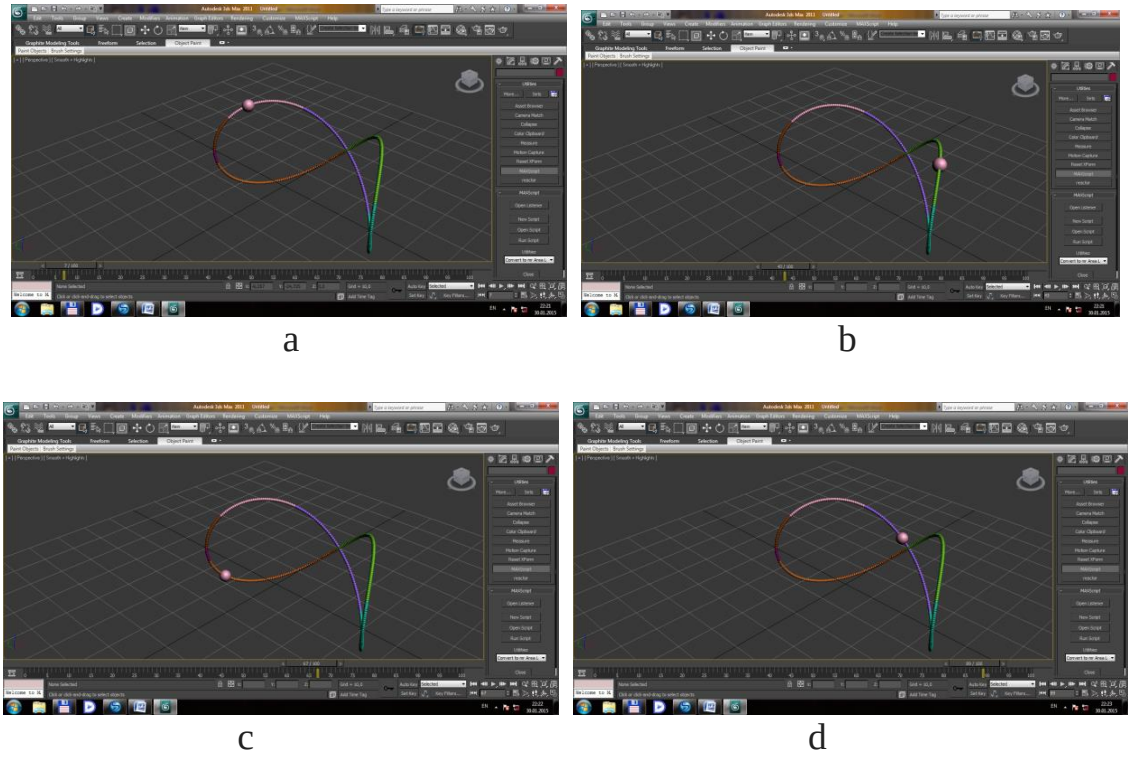
1. s=sphere radius:10 segments:32
2. fori=1 to 360 do
*3. (sphere radius:1pos:[i,sin(i)*100,0]*
4. at time i animate on
*5. (s.pos=[i,sin(i)*100,0]))*

The first line of the function sphere. 3 DS Max software component may be a function name. For example, box (), cone (), teapot (), torus (), cylinder and others. The radius of the spherical object, and segment size. The second line is the parameters used in the reproduction of the statement. Repeated operator can be used even without the variable type. The third line is the radius of the sphere, which is 1. The value of each object, variable on the axis function in the current variable i axis sin (i) and the value of Z 0 objects created in possession of the facts. The fourth line function is used "at time i animate on".

This Max Script function is one of the main methods of creating animated movements. Time must be a part of slider 360. Since each time i corresponds to each variable value portion slider sin (i), depending on the graphics allow the moving object on the basis of the full-period.[5],[6].

Coordinate Z- axis of the three-dimensional nature of the conditions. We will consider as an example

Figure 3.



a b c d

Fig. 3. Presents a set of 3d Max, Max Script with trigonometric equation.

The code is written in Max Script:

a=sphere radius:2fori=0 to 360 do(at time i animate on
*(a.pos=[sin(i)*sin(i)*50,cos(i)*50,cos(i)*sin(i)*50]))*
fori=0 to 360 do
*(sphere radius:0.5 pos:[sin(i)*sin(i)*50,cos(i)*50,cos(i)*sin(i)*50]))*

3. The creation of animated actions by means of integral equations of moving object on the basis of the integrated graphics of the equation.

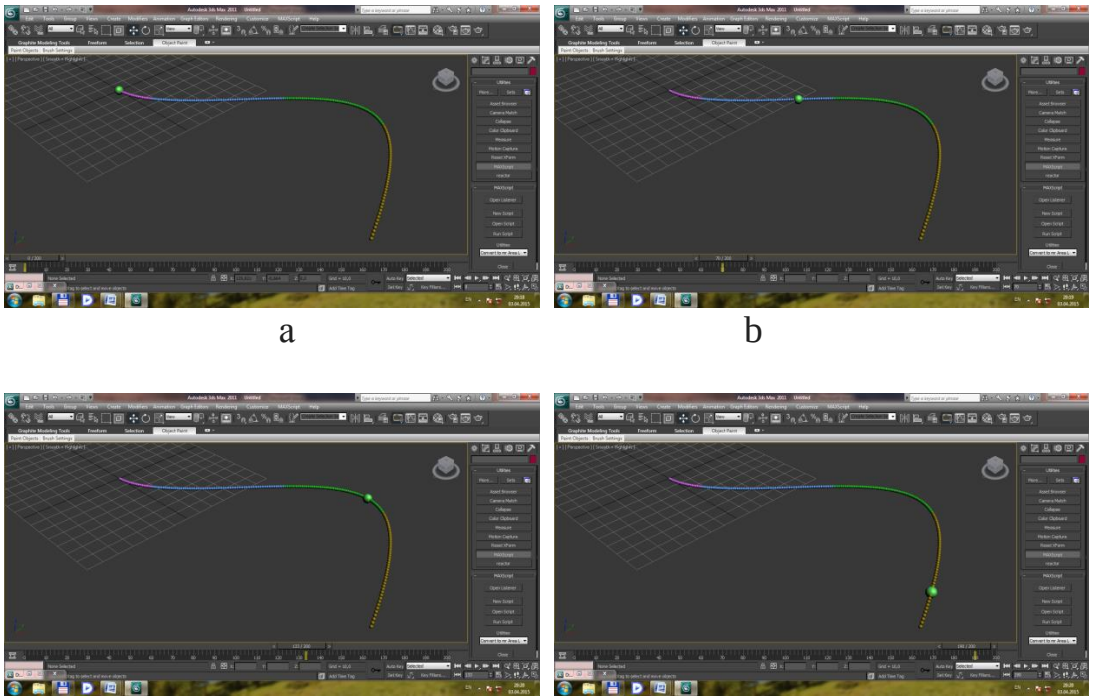
Integrated rectangular method for this value will be charged. The initial conditions are a = 1 , b = 10 , n = 10 . Figure 4

$$\int_1^{10} (2 * x + 6)\cos\left(\frac{x}{2}\right) * \sin\left(\frac{x}{2}\right) dx$$

The code is written in Max Script:

f=sphere radius:3
a=1;
b=10;

```
n=10;
s=1;
fori=1 to 200 do(
    h=(b-a)/n as float;
    x=h*i as float;
    y=(2*x+6)*cos(x/2)*sin(x/2) as float;
    s=y*h as float;
    sphere radius:1 pos:[i,s,0]
    at time i animate on(
            f.pos=[i,s,0]))
```



a b c d

Fig. 4. Presents a set of 3d Max, Max Script with integral equation 1.

4. The creation of animated action by means of differential equations.

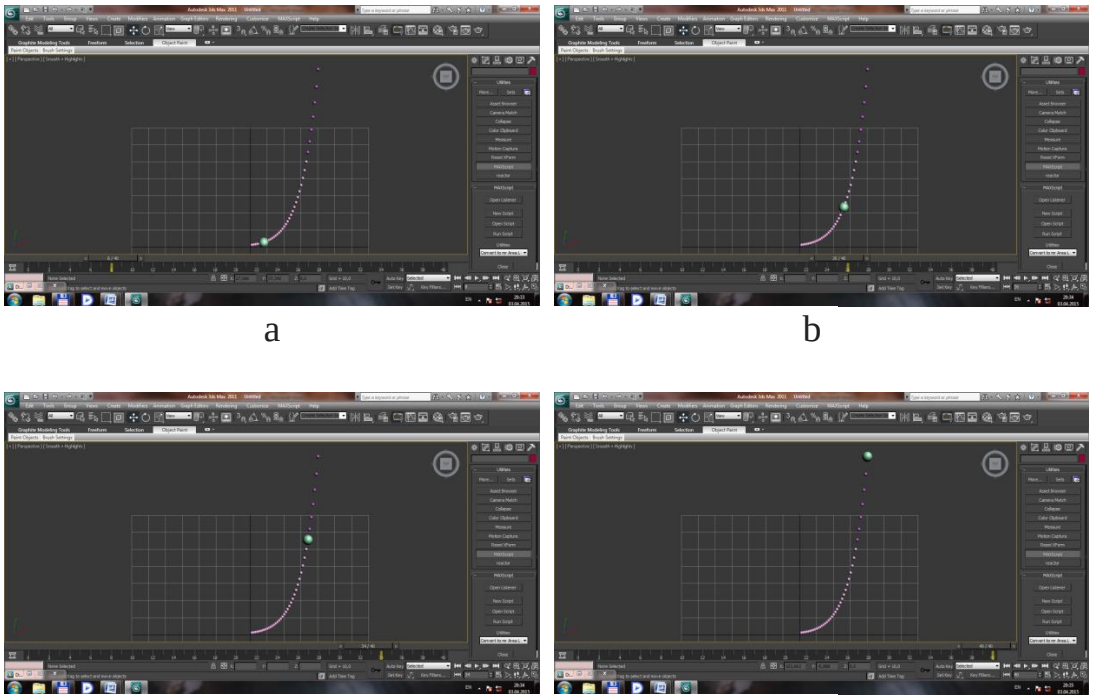
Many of the events and processes are expressed by differential equations [3]. Further, we proposed the creation of animated actions on the basis of the first order of differential equations. For this purpose, in accordance with the principle of solving Rung-Kutta's differential equations methods. The initial conditions are x = 0, y = 1, h = 0,1. **Figure 5.**

$$y' = x + y$$

the code is written in Max Script:

```
a=sphere radius:3
```

```
x=0;
y=1;
h=0.1 as float;
fori=1 to 40 do(
    k1=h*(x+y) as float;
    k2=h*(x+y+0.5*h+0.5*k1) as float;
    k3=h*(x+y+0.5*h+0.5*k2) as float;
    k4=h*(x+y+h+k3) as float;
    dy=(k1+2*k2+2*k3+k4)/6 as float;
    x=x+h as float;
    y=y+dy as float;
sphere radius:1 pos:[i,y,0]
    at time i animate on(
                a.pos=[i,y,0]))
```



a b c d

Fig. 5. Presents a set of 3d Max, MaxScript with differential equation.

We will consider the motion of the object based on the solution of the differential equation system (5). We find a number of solutions of differential equations of the second order by the Rung-Kutta method. Created graph based on the obtained results will provide the basis of the animated motion **(Figure 6).**

$$\begin{cases} y' = z \\ z' = -2z - y + x \end{cases}$$

The initial conditions are x = 0, y = 1, z = 0, h = 0,2.
The code is written in Max Script:

```
a=sphere radius:3
x=0;
y=1;
z=0;
h=0.2 as float;
fori=1 to 200 do(
    k1=z as float;
    p1=-2*z-y+x as float;
    k2=z+p1*h/2 as float;
    p2=(-2*(z+p1*h/2)-(y+h*k1/2)+x+h/2) as float;
    k3=z+p2*h/2 as float;
    p3=(-2*(z+p2*h/2)-(y+h*k2/2)+x+h/2) as float;
    k4=z+p3*h as float;
    p4=(-2*(z+p3*h)-(y+h*k3)+x+h) as float;
    dy=h*(k1+2*k2+2*k3+k4)/6 as float;
    dz=h*(p1+2*p2+2*p3+p4)/6 as float;
    x=x+h as float;     y=y+dy as float;    z=z+dz as float;
sphere radius:1 pos:[i,y,0]
    at time i animate on(a.pos=[i,y,0]))
```

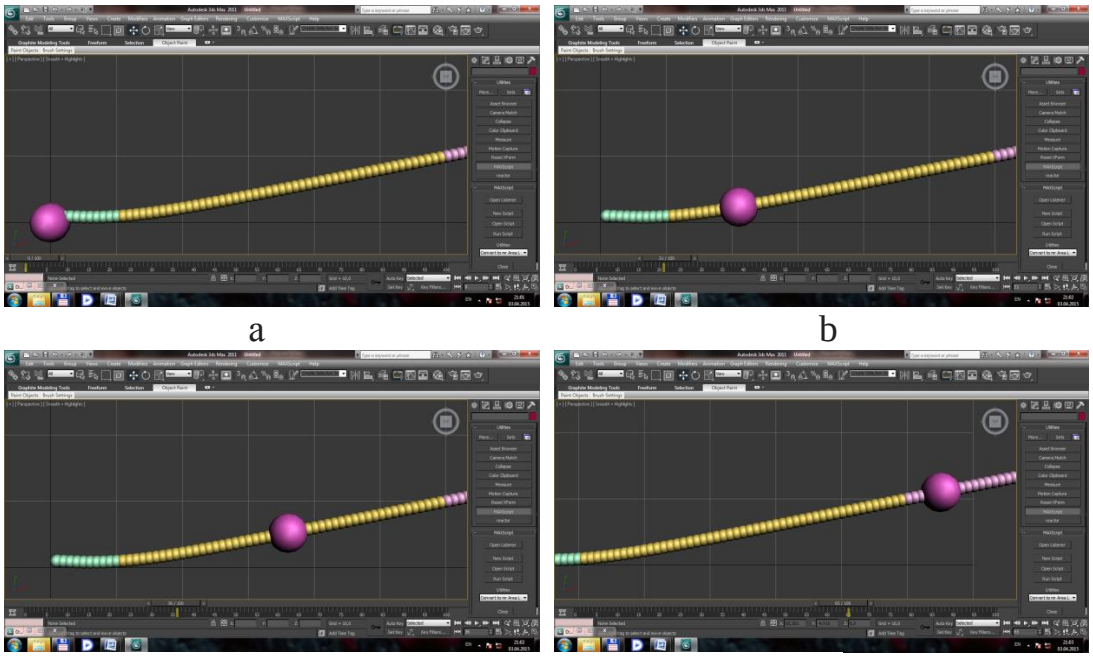


Fig. 6. Presents a set of 3d Max, Max Script with a system of differential equations.

Conclusion

In a conclusion, it should be noted that the use of mathematical formulas that describe the mathematical model to create an animated motion in 3ds Max software environment Max Script opens up new possibilities of fundamental research activities and process equipment. The ability to create a visual motion of graphic object on complex mathematical calculations, which are calculated integral-differential equations, shown in this paper allows a deep study of the researching object being studied by more sophisticated mathematical model.

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