EXPERIMENT 3-APPLICATION OF DIFFERENTIAL EQUATION IN GAME THEORY

AIM:

TO STUDY ABOUT HOW SOLVING DIFFERENTIAL EQUATION IS USEFUL IN THE FIELD OF GAME THEORY IN COMPUTER SCIENCE

MATHEMATICAL BAKGROUND:

In today’s world we see a lot of games being developed.Some are simple games like Mario,dave and other very complex like GTA,Clash of Clans,Age of empires.But in all these games,there is a situation where the user controls the character and the computer responds according to the input given by user.To calculate the response to the set of inputs given by the user,differential equation is used.For example when a user wants to make a character jump and run,it is necessary to calculate at what position the character needs to land after the jump occurs.For this ,the solution of the equation,

https://qph.is.quoracdn.net/main-qimg-308127cb7401bd87952d85885cff21dc?convert_to_webp=true

gives the position required.Here P is the position of the character and g is acceleration downwards.The value of g is arbitrary .The game developer can choose any value.The constraint is that p(0) is 0 and Dp(0)=0.

To solve the equation one must do the following:

Express the function in the form

displaymath197

Write down the **characteristic equation**

displaymath199

**(1)**

If tex2html_wrap_inline201 and tex2html_wrap_inline203 are distinct real numbers (this happens if tex2html_wrap_inline205 ), then the general solution is

displaymath207

**(2)**

If tex2html_wrap_inline209 (which happens if tex2html_wrap_inline211 ), then the general solution is

displaymath213

**(3)**

If tex2html_wrap_inline201 and tex2html_wrap_inline203 are complex numbers (which happens if tex2html_wrap_inline219 ), then the general solution is

displaymath221

where

displaymath223

that is

displaymath225

MATLAB CODE:

clc

clear all

close all

x=input(‘Enter the position’);

g=9.8;

eqn=’D2x-g=0’;

inits=’p(0)=x’;

soln=dsolve(eqn,inits,’t’);

disp(soln);

clc

clear all

close all

eqn=input(‘enter the equation:’);

inits=input(‘Enter the conditions’);

y=dsolve(eqn,inik);

soln=[‘y(t)=0,char(simplify(y))];

disp(soln);

OUTPUT:

ENGINEERING INTERPRETATION:

Differential equation is definitely an important part in games.Apart from jumping and moving,it is also used to do many other movements like shooting a gun(where bullet position is calculated on the basis of differential equations),driving a car(car’s position based on acceleration and deceleration is calculated by differential equations),running,etc.In each and very case,there are different differential equations and different constraints, and in each and every case the final output is finding the new position of the object.One can also use them for complex movements like fighting etc. where a lot of differential equations are required to be solved simultaneously.Wherever there is physics of motion involved,there is differential equation .