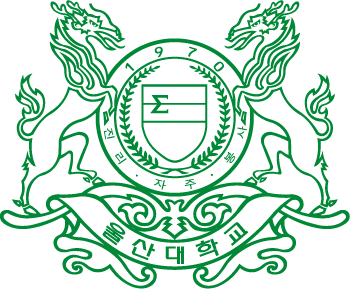
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| **R E P O R T** | |
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| **학 과** | **전기전자정보시스템공학전공** |
| **교수님 (Professor)** | **KANG, HEE-JUN 교수님** |
| **학 번 (Student ID)** | **20175308** |
| **이 름 (Name)** | **La Phuong Ha** |
| **제출일 (Times)** | **20190927** |



La Phuong Ha – ID: 20175308 – Assignment 4: Robot Manipulators

ECCL | #7-429 | Email: [laphuongha@gmail.com](mailto:laphuongha@gmail.com)

1. Show the posture of the object at each second to 5s

We have:  with 

Hence, the position of cube at the time (t+1) is calculated by: 

Matlab code:

t = 0:1:5;

delta = 1;

a = zeros(1,6); %Alpha

b = zeros(1,6); %Beta

g = zeros(1,6); %Gamma

a\_dot = zeros(1,6); %Velocity of Alpha

b\_dot = zeros(1,6); %Velocity of Beta

g\_dot = zeros(1,6); %Velocity of Gamma

w\_x = 0.01\*sin(t); %Gyroscope at x coordinate

w\_y = 0.01\*sin(2\*t); %Gyroscope at y coordinate

w\_z = 0.1\*cos(t); %Gyroscope at z coordinate

% data of Gyroscopes

a(1,1) = 10\*3.14/180;

b(1,1) = 10\*3.14/180;

g(1,1) = 10\*3.14/180;

for i = 1:5

E = [ 0, -sin(a(i)) , cos(a(i))\*sin(b(i));

0, cos(a(i)) , sin(a(i))\*sin(b(i));

1, 0 , cos(b(i))];

G1 = [w\_x(i); w\_y(i); w\_z(i)];

G2 = inv(E)\*G1;

a\_dot(1,i) = G2(1,1);

b\_dot(1,i) = G2(2,1);

g\_dot(1,i) = G2(3,1);

%Position of cube at t+1

a(1,i+1) = a(1,i) + delta\*a\_dot(1,i);

b(1,i+1) = b(1,i) + delta\*b\_dot(1,i);

g(1,i+1) = g(1,i) + delta\*g\_dot(1,i);

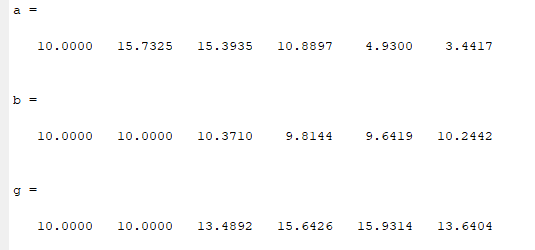
end

a=a\*180/3.14

b=b\*180/3.14

g=g\*180/3.14

The output of Matlab:



To demontrate the movement of the cube, a Matlab code is run:

%Define the cubic, 4 face around

X = [0 0 0 0 0 1; 1 0 1 1 1 1; 1 0 1 1 1 1; 0 0 0 0 0 1];

Y = [0 0 0 0 1 0; 0 1 0 0 1 1; 0 1 1 1 1 1; 0 0 1 1 1 0];

Z = [0 0 1 0 0 0; 0 0 1 0 0 0; 1 1 1 0 1 1; 1 1 1 0 1 1];

xc=0; yc=0; zc=0; % coordinated of the center

L=10; % cube size (length of an edge)

alpha=0.8; % transparency (max=1=opaque)

%Draw the cubic at the initial

X = L\*(X-0.5) + xc;

Y = L\*(Y-0.5) + yc;

Z = L\*(Z-0.5) + zc;

C= [0 0.5 0.8 0.2 0.3 1.2]; % color spec.

%Draw init

subplot(3,2,1);

fill3(X,Y,Z,C,'FaceAlpha',alpha); % draw cube

axis equal;

grid on;

axis([-10 10 -10 10]);

AZ=-20; % azimuth

EL=25; % elevation

view(AZ,EL); % orientation of the axes

%Draw the cubic by the times

for j=1:5

%Rotation Euler Matrix by ZYX

a11 = cos(a(j))\*cos(b(j));

a21 = sin(a(j))\*cos(b(j));

a31 = -sin(b(j));

a12 = cos(a(j))\*sin(b(j))\*sin(g(j)) - sin(a(j))\*cos(g(j));

a22 = sin(a(j))\*sin(b(j))\*sin(g(j)) + cos(a(j))\*cos(g(j));

a32 = cos(b(j))\*sin(g(j));

a13 = cos(a(j))\*sin(b(j))\*cos(g(j))+sin(a(j))\*sin(g(j));

a23 = sin(a(j))\*sin(b(j))\*cos(g(j))-cos(a(j))\*sin(g(j));

a33 = cos(b(j))\*cos(g(j));

K = [a11, a12, a13; a21, a22, a23; a31, a32, a33];

for i=1:4

XYZ=[X(i,:); Y(i,:); Z(i,:)];

VXYZ=K\*XYZ;

X(i,:)=VXYZ(1,:);

Y(i,:)=VXYZ(2,:);

Z(i,:)=VXYZ(3,:);

end

%Draw state j

subplot(3,2,j+1);

fill3(X,Y,Z,C,'FaceAlpha',alpha);

axis equal;

axis([-10 10 -10 10]);

grid on;

AZ=-20;

EL=25;

view(AZ,EL);

end

K = [a11, a12, a13; a21, a22, a23; a31, a32, a33];

for i=1:4

XYZ=[X(i,:); Y(i,:); Z(i,:)];

VXYZ=K\*XYZ;

X(i,:)=VXYZ(1,:);

Y(i,:)=VXYZ(2,:);

Z(i,:)=VXYZ(3,:);

end

%Draw state j

subplot(3,2,j+1);

fill3(X,Y,Z,C,'FaceAlpha',alpha);

axis equal;

axis([-10 10 -10 10]);

grid on;

AZ=-20;

EL=25;

view(AZ,EL);

end

The output of the matlab code:

Output of the code:

