ACOSE ASSIGNMENT

Spheroid from “New family of 4-D hyperchaotic and chaotic systems with quadric surfaces of equilibria”

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Matlab Program

```
clc; clear; close all;
syms x1 x2 x3 x4 h d g a b
h=5; d=3; g=1; a=1; b=1/sqrt(2);
%%%Solving PMSG model%%%
[solx1,solx2,solx3,solx4,Parameter,Condition]=solve(x3==0,-
x3*(x2*h+d*x2^2+x1*x3)==0,(x1^2/a^2)+(x2^2/a^2)+(x4^2/b^2)-
1==0,-g*x3*x4==0,x1,x2,x3,x4,'ReturnCondition',true );
x1val=vpa(solx1);
x2val=vpa(solx2);
x3val=vpa(solx3);
x4val=vpa(solx4);

%***********one of the possible Infinite Equilibrium points
****************%
E=[x1val(3,:);x2val(3,:);x3val(3,:);x4val(3,:)];  %%
[sqrt(- 2.0*z^2 - 1.0*z1^2 + 1.0),z1,0,z]

Z=linspace(-3,3,3500);
Z1=Z;
Length=length(Z);
L=1;
 for i=1:Length
 for j=1:Length
 if((- 2.0*Z(i)^2 - 1.0*Z1(j)^2 + 1.0)>=0)
 Xn(L)=(- 2.0*Z(i)^2 - 1.0*Z1(j)^2 + 1.0)^(1/2);
 Yn(L)=Z1(j);
 Zn(L)=Z(i);
 L=L+1;
 end
 end
 end
X_total=[Xn -Xn]; % all possible X-cordinate points
Y_total=[Yn Yn];  % all possible Y-cordinate points
Z_total=[Zn Zn];  % all possible Z-cordinate points

scatter3(X_total,Y_total,Z_total,'MarkerEdgeColor','blue');
set(gca,'XLim',[-2 2],'YLim',[-2 2],'ZLim',[-1 1])
xlabel('X axes'); ylabel('Y axes'); zlabel('Z
axes');title('Spheroid')
```

Result

>> x1val

```
x1val =

-1.0*(1.0 - 2.0*z^2)^(1/2)

(-1.0*(z - 1.0)*(z + 1.0))^(1/2)

(- 2.0*z^2 - 1.0*z1^2 + 1.0)^(1/2)

-0.47140452079103168293389624140323*(- 9.0*z^2 - 8.0)^(1/2)

0.47140452079103168293389624140323*(- 9.0*z^2 - 8.0)^(1/2)

-1.0*(-1.0*(z - 1.0)*(z + 1.0))^(1/2)

(1.0 - 2.0*z^2)^(1/2)

-1.0*(- 2.0*z^2 - 1.0*z1^2 + 1.0)^(1/2)
```

>> x2val

```
x2val =

0

z

z1

-1.66666666666666666666666666666667

-1.66666666666666666666666666666667

z

0

z1
```

>> x3val

```
x3val =

0

0

0

0

0

0

0

0
```

```
>> x4val
```

```
x4val =

z

0

z

z

z

0

z

z
```

```
>> E
```

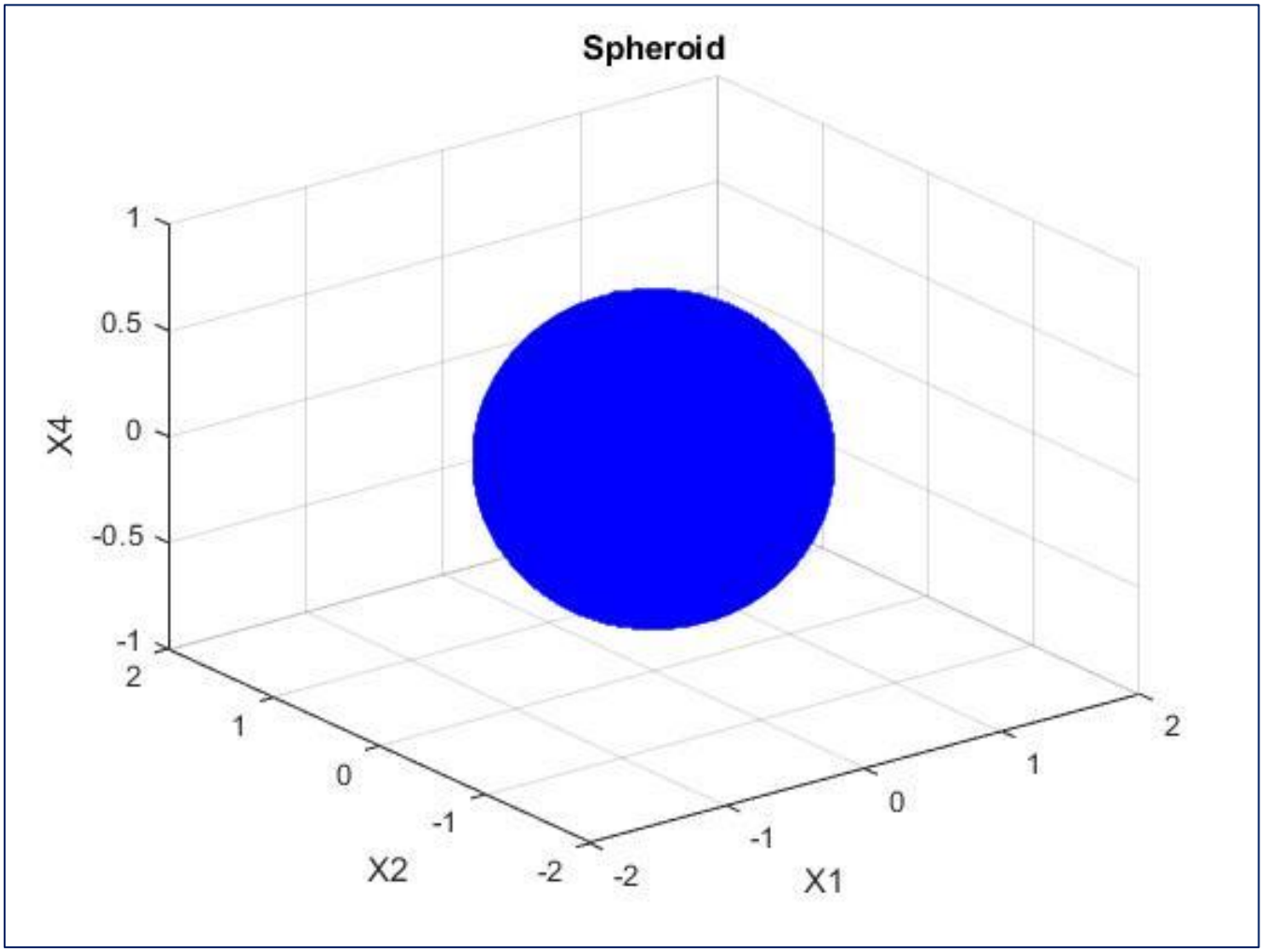
```
E =

(- 2.0*z^2 - 1.0*z1^2 + 1.0)^(1/2)

z1

0

z
```



Figure

References

1. https://www.youtube.com/watch?v=8Or_RZCGxwE&t=5s

2. Singh, Jay & Roy, Binoy & Jafari, Sajad. (2017). New Family of 4-D Hyperchaotic and Chaotic Systems with quadric Surfaces of Equilibria. Chaos Solitons & Fractals. 106. 243–257. 10.1016/j.chaos.2017.11.030.