

```

% Gram-Schmidt Orthogonalization-2
% Name: Sachin Chauhan
% Roll# 23SP06007
% Course: Advanced Communication Laboratory
% //////////////////////////////////
clc;
clear global;
close all;
% //////////////////////////////////

syms x;
%defining time limits
t_low=0;
t_high=3;
%defining signals
s1=2*(heaviside(x)-heaviside(x-1));
s2=4*(-heaviside(x)+heaviside(x-2));
s3=3*(heaviside(x)-heaviside(x-3));
phi=[];%basis fucntion array
s=[s1,s2,s3];%signal array
%calculating basis function
for i=1:length(s)
    f_tilda=s(i);
    if i>1
        for j=1:i-1%calculating f_tilda
            f_tilda=f_tilda-innerProduct(phi(j),f_tilda,t_low,t_high)*phi(j);
        end
    end
    % if(f_tilda~=0)
    phi=[phi f_tilda/(calc_norm(f_tilda,t_low,t_high))];%calulating phi(t) for the ith signal and appending it to the phi array
    % end
end

%storing coefficients in an array for plotting the constellation diagram
for i=1:length(s)
    for j=1:length(phi)
        if(isnan(phi(j)))==0
            points(i,j)=innerProduct(phi(j),s(i),t_low,t_high);
        end
    end
end

%plotting signals
figure(1);
for i=1:length(s)
    subplot(2,2,i);
    fplot(s(i),'r');
    xlim([-5 5]);
    ylim([-5 5]);
    grid on;
    xlabel('Time');
    ylabel('Amplitude');
    title(sprintf('s%d(t)',i));
end

%plotting the basis functions
figure(2);
for i=1:length(phi)
    hold on;
    subplot(2,2,i);
    % fplot(f_tilda_arr(i));
    fplot(phi(i),'r');
    grid on;
    xlim([-5 5]);
    ylim([-5 5]);
    xlabel('Time(sec)');
    ylabel('Amplitude');
    title(sprintf('Phi-%d',i));
end

```

```
end
%plotting the constellation diagram
[row col]=size(points);
x=points(:,1);
y=points(:,2);
z=points(:,3);
figure(3);
scatter3(x,y,z,'r','filled');
xlabel('Phi1');
ylabel('Phi2');
zlabel('Phi3');
title('Constellation Plot');
grid on;

%user defined function for calculating norm
function norm=calc_norm(s,t_low,t_high)
    norm=sqrt(int(s*s,t_low,t_high));
end
%user defined function for calculating innerproduct of two signals
function inner_prod=innerProduct(f1,f2,t_low,t_high)
    inner_prod=int(f1*f2,t_low,t_high);
end
```



