```
clear all
close all
clc

%%Génération SBPA et SBPA1
V = [1; 1; 1; 1; 1];
SBPA = [];
SBPA1 = [];

%Longueur SBPA = 2^n -1 = 31 => n = 5
for i = 1:31
  SBPA = [SBPA; V(5)];
  for j=1:50
     SBPA1 = [SBPA1; V(5)];
  end
  temp = -V(3)*V(5);
  V = [temp; V(1); V(2); V(3); V(4)];
end

%%Etude d'un procédé
%S(n)= 1.3 S(n-1) - 0.65 S(n-2) + 0.25 SBPA1(n-1) + 0.6 SBPA1(n-3)
Sn = [0; SBPA1(1); SBPA1(2)];
 for k = 4:1550
   Z = 1.3*Sn(k-1) - 0.65*Sn(k-2) + 0.25*SBPA1(k-1) + 0.6*SBPA1(k-3);
   Sn = [Sn; Z];
 end
 figure(1)
 plot(Sn);

 %%MCS
 %S(n)= a1 S(n-1) + a2 S(n-2) + b2 SBPA1(n-1) + b3 SBPA1(n-3)
 Y = Sn(4:1550);
 X = [Sn(3:1549) Sn(2:1548) SBPA1(3:1549) SBPA1(1:1547)];
 theta1 = inv((X'*X))* X' * Y;
 b2 =theta1(3)
 b3 =theta1(4)
 a1 =theta1(1)
 a2 =theta1(2)

 %%MCS avec bruit
 Sn2 = Sn + 1.6.*randn(1550,1);
 figure(2)
 plot(Sn2, 'r');
 Y = Sn2(4:1550);
 X = [Sn2(3:1549) Sn2(2:1548) SBPA1(3:1549) SBPA1(1:1547) ];
 theta2 = inv((X'*X))* X' * Y;
 b2MCS =theta2(3)
 b3MCS =theta2(4)
 a1MCS =theta2(1)
 a2MCS =theta2(2)


ind = [0; 0; 1];
for i=4 : 1 : 50
   ZB = theta1(1)*ind(i-1) + theta1(2)*ind(i-2) + theta1(3) + theta1(4);
   ind = [ind; ZB];
end

indB = [0; 0; 1];
```

```
for i=4 : 1 : 50
   ZC = theta2(1)*ind(i-1) + theta2(2)*ind(i-2) + theta2(3) + theta2(4);
   indB = [indB; ZC];
end

figure(3)
plot(ind);
hold on
plot(indB);

%%MCG ordre 1 signal bruité
ek = 1;
ekm1 = 1000;
uMCG = SBPA1;%Mesures entrée
yMCG = Sn2;%Mesures sortie
epsilon = 0.001;

while abs(ek-ekm1) > epsilon
   UMCG=[yMCG(3:1549) yMCG(2:1548) uMCG(3:1549) uMCG(1:1547)];
   YMCG=yMCG(4:1550);
   theta3 = inv((UMCG'*UMCG))* UMCG' * YMCG;
   e = YMCG - UMCG * theta3;
   e1= e(2:1547);
   Xe = -e(1:1546);
   f = inv(Xe'*Xe)*Xe'*e1;
   Yet(1,1)= yMCG(1,1);
   Uet(1,1)= uMCG(1,1);
   for i = 2 : 1550
     Yet(i,1) = yMCG(i)+f(1)*yMCG(i-1);
     Uet(i,1) = uMCG(i)+f(1)*uMCG(i-1);
   end
   yMCG = Yet;
   uMCG = Uet;
   ekm1 = ek;
   ek = e'*e;
end

 b2MCG =theta3(3)
 b3MCG =theta3(4)
 a1MCG =theta3(1)
 a2MCG =theta3(2)
indMCG = [0; 0; 1];
for i=4 : 1 : 50
   ZB = theta3(1)*ind(i-1) + theta3(2)*ind(i-2) + theta3(3) + theta3(4);
   indMCG = [indMCG; ZB];
end

hold on
plot(indMCG)

%%Methode du gradient
e=10;
ygrad=Sn2;
ugrad=SBPA1;
thetaK=theta3;

alpha=1e-5;
eps=1e-5;
```

```
while max(abs(e))>eps
   ymgrad(1,1)=0;
   ymgrad(2,1)=thetaK(3)*ugrad(1);
   ymgrad(3,1)=thetaK(3)*ugrad(1)+ymgrad(2)*thetaK(1);
   for i=4:1550
      ymgrad(i,1)=thetaK(1)*ymgrad(i-1)+thetaK(2)*ymgrad(i-2)+thetaK(3)*ugrad(i-1)+thetaK(4)*ugrad(i-3);
   end

   gk=[0;0;0;0];
   for i=4:1550
      gk=gk+2*(ygrad(i)-ymgrad(i))*[-ymgrad(i-1); -ymgrad(i-2); -ugrad(i-1); -ugrad(i-3)];
   end
   thetaKp1=thetaK-alpha*gk;
   e=thetaK-thetaKp1;
   thetaK=thetaKp1;
end
thetaK
ind4 = [0; 0; 1];
for i=4 : 1 : 50
   ZXX = thetaK(1)*ind(i-1) + thetaK(2)*ind(i-2) + thetaK(3) + thetaK(4);
   ind4 = [ind4; ZXX];
end
 hold on
 plot(ind4);
legend('Reponse impulsionnelle', 'Reponse impulsionnelle MCS', 'Reponse impulsionnelle MCG', 'Reponse
impulsionnelle Gradient');
```