

附錄 E: 例二: 乙炔(acetylene)轉換比例之分析中各狀況下之 MATLAB

程式

狀況一：不刪除特徵值較小的主成分、採用 M.W.G.原方法

(1) 未加上 $a_j \in [0,1]$ 限制條件

```
format short
```

```
x=zeros(16,9);
```

```
x(:,1)=[1300;1300;1300;1300;1300;1300;1200;1200;1200;1200;1200;1200;1100;1100;1100;1100];
```

```
x(:,2)=[7.5;9.0;11.0;13.5;17.0;23.0;5.3;7.5;11.0;13.5;17.0;23.0;5.3;7.5;11.0;17.0];
```

```
x(:,3)=[0.0120;0.0120;0.0115;0.0130;0.0135;0.0120;0.0400;0.0380;0.0320;0.0260;0.0340;0.0410;0.0840;0.0980;0.0920;0.0860];
```

```
x(:,1)=(x(:,1)-(1212.5*ones(16,1)))/80.623;
```

```
x(:,2)=(x(:,2)-(12.44*ones(16,1)))/5.662;
```

```
x(:,3)=(x(:,3)-(0.0403*ones(16,1)))/0.03164;
```

```
for i=1:16
```

```
    x(i,4)=x(i,1)*x(i,2);
```

```
end
```

```
for j=1:16
```

```
    x(j,5)=x(j,1)*x(j,3);
```

```
end
```

```
for k=1:16
```

```
    x(k,6)=x(k,2)*x(k,3);
```

```
end
```

```
for l=1:16
```

```

    x(1,7)=x(1,1)^2;
end
for m=1:16
    x(m,8)=x(m,2)^2;
end
for n=1:16
    x(n,9)=x(n,3)^2;
end
x;
x1=(x(:,1)-(mean(x(:,1))*ones(16,1)))/(std(x(:,1))*sqrt(15));
x2=(x(:,2)-(mean(x(:,2))*ones(16,1)))/(std(x(:,2))*sqrt(15));
x3=(x(:,3)-(mean(x(:,3))*ones(16,1)))/(std(x(:,3))*sqrt(15));
x4=(x(:,4)-(mean(x(:,4))*ones(16,1)))/(std(x(:,4))*sqrt(15));
x5=(x(:,5)-(mean(x(:,5))*ones(16,1)))/(std(x(:,5))*sqrt(15));
x6=(x(:,6)-(mean(x(:,6))*ones(16,1)))/(std(x(:,6))*sqrt(15));
x7=(x(:,7)-(mean(x(:,7))*ones(16,1)))/(std(x(:,7))*sqrt(15));
x8=(x(:,8)-(mean(x(:,8))*ones(16,1)))/(std(x(:,8))*sqrt(15));
x9=(x(:,9)-(mean(x(:,9))*ones(16,1)))/(std(x(:,9))*sqrt(15));
x=[x1 x2 x3 x4 x5 x6 x7 x8 x9];
xx=x'*x;
[v,d]=eig(xx);
v=fliplr(v)
d=rot90(rot90(d))
y=[0.27979 0.30583 0.31234 0.26894 0.24724 0.18214 0.1759 -0.09995 -0.03486
-0.02401 0.04109 0.05194 0.458 0.4146 -0.33865 -0.14335]';
xy=[0.3022;-0.2299;-0.1979;0.2915;-0.1522;-0.3322;0.2206;0.1215;0.0824];

```

```

betahat=inv(xx)*xy
gammahat=v'*betahat
A=zeros(7,9);v2=zeros(3,9);
d1=v(3,:);d2=v(9,:);
v(9,:)=[];v(3,:)=[];
for k=1:7
    if k<=2
        v2=[v(k,:);d1;d2];
    else
        v2=[d1;v(k,:);d2];
    end
    for l=1:9
        A(k,l)=1-v2(:,l)*inv(v2*inv(d)*v2')*v2*gammahat/(d(l,1)*gammahat(l,1));
    end
end
A
B=zeros(7,9);
for m=1:7
    for n=1:9
        B(m,n)=(1-A(m,n))^2*d(n,n)*gammahat(n,1)^2;
    end
end
B
U31=sum(B(1,:))
U32=sum(B(2,:))
U34=sum(B(3,:))

```

U35=sum(B(4,:))

U36=sum(B(5,:))

U37=sum(B(6,:))

U38=sum(B(7,:))

U3=[U31 U32 U34 U35 U36 U37 U38]

U3m=min(U3)

U2m =0.0235

mse=0.14256/(16-7-1)

F=(U3m-U2m)/mse

A(4,:)

a1=A(4,1);

a2=A(4,2);

a3=A(4,3);

a4=A(4,4);

a5=A(4,5);

a6=A(4,6);

a7=A(4,7);

a8=A(4,8);

a9=A(4,9);

A=zeros(9,9);

A(1,1)=a1;

A(2,2)=a2;

A(3,3)=a3;

A(4,4)=a4;

A(5,5)=a5;

A(6,6)=a6;

$$A(7,7)=a7;$$

$$A(8,8)=a8;$$

$$A(9,9)=a9;$$

A

$$\text{betatelta}=\mathbf{v}^* \mathbf{A}^* \text{gammahat}$$

$$\text{squares}=0.14256/(16-7-1)$$

$$(\text{diag}(\mathbf{v}^* \text{inv}(\mathbf{d})^* \mathbf{v}'))^* \text{squares}$$

(2) 加上 $a_j \in [0,1]$ 限制條件

```
format short
x=zeros(16,9);
x(:,1)=[1300;1300;1300;1300;1300;1300;1200;1200;1200;1200;1200;1200;1100;1100;1100;1100];
x(:,2)=[7.5;9.0;11.0;13.5;17.0;23.0;5.3;7.5;11.0;13.5;17.0;23.0;5.3;7.5;11.0;17.0];
x(:,3)=[0.0120;0.0120;0.0115;0.0130;0.0135;0.0120;0.0400;0.0380;0.0320;0.0260;0.0340;0.0410;0.0840;0.0980;0.0920;0.0860];
x(:,1)=(x(:,1)-(1212.5*ones(16,1)))/80.623;
x(:,2)=(x(:,2)-(12.44*ones(16,1)))/5.662;
x(:,3)=(x(:,3)-(0.0403*ones(16,1)))/0.03164;
for i=1:16
    x(i,4)=x(i,1)*x(i,2);
end
for j=1:16
    x(j,5)=x(j,1)*x(j,3);
end
for k=1:16
    x(k,6)=x(k,2)*x(k,3);
end
for l=1:16
    x(l,7)=x(l,1)^2;
end
for m=1:16
    x(m,8)=x(m,2)^2;
end
for n=1:16
    x(n,9)=x(n,3)^2;
end
x;
x1=(x(:,1)-(mean(x(:,1))*ones(16,1)))/(std(x(:,1))*sqrt(15));
x2=(x(:,2)-(mean(x(:,2))*ones(16,1)))/(std(x(:,2))*sqrt(15));
x3=(x(:,3)-(mean(x(:,3))*ones(16,1)))/(std(x(:,3))*sqrt(15));
```

```

x4=(x(:,4)-(mean(x(:,4))*ones(16,1)))/(std(x(:,4))*sqrt(15));
x5=(x(:,5)-(mean(x(:,5))*ones(16,1)))/(std(x(:,5))*sqrt(15));
x6=(x(:,6)-(mean(x(:,6))*ones(16,1)))/(std(x(:,6))*sqrt(15));
x7=(x(:,7)-(mean(x(:,7))*ones(16,1)))/(std(x(:,7))*sqrt(15));
x8=(x(:,8)-(mean(x(:,8))*ones(16,1)))/(std(x(:,8))*sqrt(15));
x9=(x(:,9)-(mean(x(:,9))*ones(16,1)))/(std(x(:,9))*sqrt(15));
x=[x1 x2 x3 x4 x5 x6 x7 x8 x9];
xx=x'*x;
[v,d]=eig(xx);
v=fliplr(v);
d=rot90(rot90(d));
y=[0.27979 0.30583 0.31234 0.26894 0.24724 0.18214 0.1759 -0.09995 -0.03486
-0.02401 0.04109 0.05194 0.458 0.4146 -0.33865 -0.14335]';
xy=[0.3022;-0.2299;-0.1979;0.2915;-0.1522;-0.3322;0.2206;0.1215;0.0824];
betahat=inv(xx)*xy;
gammahat=v'*betahat;
a=[1 0.997844 0.991807 0.999320 0.995938 0.945585 1 0.344582 0.000320
0.768973 1 0.995818 0.125244 0.033111 0.756555 0.907772 1 0.007704
1 0.998406 1 0.997222 1 1 0.983439 1 0.007624
1 1 1 1 0.948315 0.170513 0.062011 0 0.008192
0 0 0 0 1 0 0 0 0
0.581262 1 0.842464 1 0.880109 1 0.099492 0.295027 0.009599
1 0.762870 1 1 0.456486 0.626253 1 1 0.005206
1 1 1 1 1 1 0 0 0];
b=zeros(8,9);
for i=1:8
    for j=1:9
        b(i,j)=(1-a(i,j))^2*d(j,j)*gammahat(j,1)^2;
    end
end
b
u21=sum(b(1,:))
u22=sum(b(2,:))
u23=sum(b(3,:))

```

```

u24=sum(b(4,:))
u26=sum(b(5,:))
u27=sum(b(6,:))
u28=sum(b(7,:))
u29=sum(b(8,:))
u2=[u21 u22 u23 u24 u26 u27 u28 u29 ]
u2m=min(u2)
u1m =0.0046
mse=0.14256/(16-8-1)
f=(u2m-u1m)/mse
a(3,:)
a1=a(3,1);
a2=a(3,2);
a3=a(3,3);
a4=a(3,4);
a5=a(3,5);
a6=a(3,6);
a7=a(3,7);
a8=a(3,8);
a9=a(3,9);
a=zeros(9,9);
a(1,1)=a1;
a(2,2)=a2;
a(3,3)=a3;
a(4,4)=a4;
a(5,5)=a5;
a(6,6)=a6;
a(7,7)=a7;
a(8,8)=a8;
a(9,9)=a9;
a
betatelta=v*a*v'*betahat
squares=0.14256/(16-8-1)
variance=(diag(v*a*v'*inv(xx)*v*a*v'))*squares

```


狀況二：刪除較小 2 個特徵值的主成分、採用 M.W.G 原方法

(1) 未加上 $a_j \in [0,1]$ 限制條件

```
format short
x=zeros(16,9);
x(:,1)=[1300;1300;1300;1300;1300;1300;1200;1200;1200;1200;1200;1200;1100;1100;1100;1100];
x(:,2)=[7.5;9.0;11.0;13.5;17.0;23.0;5.3;7.5;11.0;13.5;17.0;23.0;5.3;7.5;11.0;17.0];
x(:,3)=[0.0120;0.0120;0.0115;0.0130;0.0135;0.0120;0.0400;0.0380;0.0320;0.0260;0.0340;0.0410;0.0840;0.0980;0.0920;0.0860];
x(:,1)=(x(:,1)-(1212.5*ones(16,1)))/80.623;
x(:,2)=(x(:,2)-(12.44*ones(16,1)))/5.662;
x(:,3)=(x(:,3)-(0.0403*ones(16,1)))/0.03164;
for i=1:16
    x(i,4)=x(i,1)*x(i,2);
end
for j=1:16
    x(j,5)=x(j,1)*x(j,3);
end
for k=1:16
    x(k,6)=x(k,2)*x(k,3);
end
for l=1:16
    x(l,7)=x(l,1)^2;
end
for m=1:16
    x(m,8)=x(m,2)^2;
end
for n=1:16
    x(n,9)=x(n,3)^2;
end
x;
x1=(x(:,1)-(mean(x(:,1))*ones(16,1)))/(std(x(:,1))*sqrt(15));
```

```

x2=(x(:,2)-(mean(x(:,2))*ones(16,1)))/(std(x(:,2))*sqrt(15));
x3=(x(:,3)-(mean(x(:,3))*ones(16,1)))/(std(x(:,3))*sqrt(15));
x4=(x(:,4)-(mean(x(:,4))*ones(16,1)))/(std(x(:,4))*sqrt(15));
x5=(x(:,5)-(mean(x(:,5))*ones(16,1)))/(std(x(:,5))*sqrt(15));
x6=(x(:,6)-(mean(x(:,6))*ones(16,1)))/(std(x(:,6))*sqrt(15));
x7=(x(:,7)-(mean(x(:,7))*ones(16,1)))/(std(x(:,7))*sqrt(15));
x8=(x(:,8)-(mean(x(:,8))*ones(16,1)))/(std(x(:,8))*sqrt(15));
x9=(x(:,9)-(mean(x(:,9))*ones(16,1)))/(std(x(:,9))*sqrt(15));
x=[x1 x2 x3 x4 x5 x6 x7 x8 x9];
xx=x'*x;
[v,d]=eig(xx);
v=fliplr(v)
d=rot90(rot90(d))
y=[0.27979 0.30583 0.31234 0.26894 0.24724 0.18214 0.1759 -0.09995 -0.03486
-0.02401 0.04109 0.05194 0.458 0.4146 -0.33865 -0.14335]';
xy=[0.3022;-0.2299;-0.1979;0.2915;-0.1522;-0.3322;0.2206;0.1215;0.0824];
v(:,7:9)=[];
d(:,7:9)=[];d(7:9,:)=[];
betahat=inv(xx)*xy;
gammahat=v'*betahat;
A=zeros(8,6);v2=zeros(8,6);
d1=v(5,:);
v(5,:)=[];
for k=1:8
    if k<=4
        v2=[v(k,:);d1];
    else
        v2=[d1;v(k,:)];
    end
    for l=1:6
        A(k,l)=1-v2(:,l)'*inv(v2*inv(d)*v2')*v2*gammahat/(d(l,1)*gammahat(l,1));
    end
end
A

```

```

B=zeros(8,6);
for m=1:8
    for n=1:6
        B(m,n)=(1-A(m,n))^2*d(n,n)*gammahat(n,1)^2;
    end
end
B
U21=sum(B(1,:))
U22=sum(B(2,:))
U23=sum(B(3,:))
U24=sum(B(4,:))
U26=sum(B(5,:))
U27=sum(B(6,:))
U28=sum(B(7,:))
U29=sum(B(8,:))
U2=[U21 U22 U23 U24 U26 U27 U28 U29 ]
U2m=min(U2)
U1m =0.0038
mse=0.14256/(16-8-1)
F=(U2m-U1m)/mse
A(8,:)
a1=A(8,1);
a2=A(8,2);
a3=A(8,3);
a4=A(8,4);
a5=A(8,5);
a6=A(8,6);
A=zeros(6,6);
A(1,1)=a1;
A(2,2)=a2;
A(3,3)=a3;
A(4,4)=a4;
A(5,5)=a5;
A(6,6)=a6;

```

A

$\text{betatelta} = v * A * \text{gammahat}$

$\text{squares} = 0.14256 / (16 - 7 - 1)$

$(\text{diag}(v * \text{inv}(d) * v')) * \text{squares}$

(2) 加上 $a_j \in [0,1]$ 限制條件

```
format short
x=zeros(16,9);
x(:,1)=[1300;1300;1300;1300;1300;1300;1200;1200;1200;1200;1200;1200;1100;1100;1100;1100];
x(:,2)=[7.5;9.0;11.0;13.5;17.0;23.0;5.3;7.5;11.0;13.5;17.0;23.0;5.3;7.5;11.0;17.0];
x(:,3)=[0.0120;0.0120;0.0115;0.0130;0.0135;0.0120;0.0400;0.0380;0.0320;0.0260;0.0340;0.0410;0.0840;0.0980;0.0920;0.0860];
x(:,1)=(x(:,1)-(1212.5*ones(16,1)))/80.623;
x(:,2)=(x(:,2)-(12.44*ones(16,1)))/5.662;
x(:,3)=(x(:,3)-(0.0403*ones(16,1)))/0.03164;
for i=1:16
    x(i,4)=x(i,1)*x(i,2);
end
for j=1:16
    x(j,5)=x(j,1)*x(j,3);
end
for k=1:16
    x(k,6)=x(k,2)*x(k,3);
end
for l=1:16
    x(l,7)=x(l,1)^2;
end
for m=1:16
    x(m,8)=x(m,2)^2;
end
for n=1:16
    x(n,9)=x(n,3)^2;
end
x;
x1=(x(:,1)-(mean(x(:,1))*ones(16,1)))/(std(x(:,1))*sqrt(15));
x2=(x(:,2)-(mean(x(:,2))*ones(16,1)))/(std(x(:,2))*sqrt(15));
x3=(x(:,3)-(mean(x(:,3))*ones(16,1)))/(std(x(:,3))*sqrt(15));
x4=(x(:,4)-(mean(x(:,4))*ones(16,1)))/(std(x(:,4))*sqrt(15));
```

```

x5=(x(:,5)-(mean(x(:,5))*ones(16,1)))/(std(x(:,5))*sqrt(15));
x6=(x(:,6)-(mean(x(:,6))*ones(16,1)))/(std(x(:,6))*sqrt(15));
x7=(x(:,7)-(mean(x(:,7))*ones(16,1)))/(std(x(:,7))*sqrt(15));
x8=(x(:,8)-(mean(x(:,8))*ones(16,1)))/(std(x(:,8))*sqrt(15));
x9=(x(:,9)-(mean(x(:,9))*ones(16,1)))/(std(x(:,9))*sqrt(15));
x=[x1 x2 x3 x4 x5 x6 x7 x8 x9];
xx=x'*x;
[v,d]=eig(xx);
v=fliplr(v);
d=rot90(rot90(d));
v(:,8:9)=[];
d(:,8:9)=[]; d(8:9,:)=[];
y=[0.27979 0.30583 0.31234 0.26894 0.24724 0.18214 0.1759 -0.09995 -0.03486
-0.02401 0.04109 0.05194 0.458 0.4146 -0.33865 -0.14335]';
xy=[0.3022;-0.2299;-0.1979;0.2915;-0.1522;-0.3322;0.2206;0.1215;0.0824];
betahat=inv(xx)*xy;
gammahat=v'*betahat;
a=[0.916636 1 1 1 1 1 0.743189
    0 1 0 0 0 0 0
    1 0 0 0 0 0 0
    1 1 1 1 0.947077 0.165436 0.062474
    1 0.965189 1 0.906087 1 1 0.791551
    0 0 0 0 1 0 0
    0.767519 1 0.897461 1 0.922055 1 0.139640
    1 0.692874 1 1 0.294493 0.513795 1
    1 0.977356 1 0.962076 0.986403 1 0.435859];
b=zeros(9,7);
for i=1:9
    for j=1:7
        b(i,j)=(1-a(i,j))^2*d(j,j)*gammahat(j,1)^2;
    end
end
b
u11=sum(b(1,:))

```

```

u12=sum(b(2,:))
u13=sum(b(3,:))
u14=sum(b(4,:))
u15=sum(b(5,:))
u16=sum(b(6,:))
u17=sum(b(7,:))
u18=sum(b(8,:))
u19=sum(b(9,:))
u1=[u11 u12 u13 u14 u15 u16 u17 u18 u19 ]
u1m=min(u1)
mse=0.02376
f=u1m/mse
a(5,:)
a1=a(5,1);
a2=a(5,2);
a3=a(5,3);
a4=a(5,4);
a5=a(5,5);
a6=a(5,6);
a7=a(5,7);
a=zeros(7,7);
a(1,1)=a1;
a(2,2)=a2;
a(3,3)=a3;
a(4,4)=a4;
a(5,5)=a5;
a(6,6)=a6;
a(7,7)=a7;
a
%v=[v(1,:); v(2,:); v(3,:); v(4,:); v(5,:); v(6,:); v(7,:); v(8,:); d1];
betatelta=v*a*v'*betahat
squares=0.14256/(16-8-1)
variance=(diag(v*a*v'*inv(xx)*v*a*v'))*squares

```

狀況三：不刪除特徵值較小的主成分、採用 M.W.G.改良法

(1) 未加上 $a_j \in [0,1]$ 限制條件

```
format short
x=zeros(16,9);
x(:,1)=[1300;1300;1300;1300;1300;1300;1200;1200;1200;1200;1200;1200;1100;1100;1100;1100];
x(:,2)=[7.5;9.0;11.0;13.5;17.0;23.0;5.3;7.5;11.0;13.5;17.0;23.0;5.3;7.5;11.0;17.0];
x(:,3)=[0.0120;0.0120;0.0115;0.0130;0.0135;0.0120;0.0400;0.0380;0.0320;0.0260;0.0340;0.0410;0.0840;0.0980;0.0920;0.0860];
x(:,1)=(x(:,1)-(1212.5*ones(16,1)))/80.623;
x(:,2)=(x(:,2)-(12.44*ones(16,1)))/5.662;
x(:,3)=(x(:,3)-(0.0403*ones(16,1)))/0.03164;
for i=1:16
    x(i,4)=x(i,1)*x(i,2);
end
for j=1:16
    x(j,5)=x(j,1)*x(j,3);
end
for k=1:16
    x(k,6)=x(k,2)*x(k,3);
end
for l=1:16
    x(l,7)=x(l,1)^2;
end
for m=1:16
    x(m,8)=x(m,2)^2;
end
for n=1:16
    x(n,9)=x(n,3)^2;
end
x;
x1=(x(:,1)-(mean(x(:,1))*ones(16,1)))/(std(x(:,1))*sqrt(15));
x2=(x(:,2)-(mean(x(:,2))*ones(16,1)))/(std(x(:,2))*sqrt(15));
```



```

x3=(x(:,3)-(mean(x(:,3))*ones(16,1)))/(std(x(:,3))*sqrt(15));
x4=(x(:,4)-(mean(x(:,4))*ones(16,1)))/(std(x(:,4))*sqrt(15));
x5=(x(:,5)-(mean(x(:,5))*ones(16,1)))/(std(x(:,5))*sqrt(15));
x6=(x(:,6)-(mean(x(:,6))*ones(16,1)))/(std(x(:,6))*sqrt(15));
x7=(x(:,7)-(mean(x(:,7))*ones(16,1)))/(std(x(:,7))*sqrt(15));
x8=(x(:,8)-(mean(x(:,8))*ones(16,1)))/(std(x(:,8))*sqrt(15));
x9=(x(:,9)-(mean(x(:,9))*ones(16,1)))/(std(x(:,9))*sqrt(15));
x=[x1 x2 x3 x4 x5 x6 x7 x8 x9];
xx=x'*x;
xx(9,:)=[];xx(:,9)=[];
[v,d]=eig(xx);
v=fliplr(v)
v=[v(:,1) v(:,2) v(:,3) v(:,4) v(:,5) v(:,8) v(:,7) v(:,6)]
d=rot90(rot90(d))
d6=d(6,6);d8=d(8,8);
d(6,6)=d8;d(8,8)=d6;
y=[0.27979 0.30583 0.31234 0.26894 0.24724 0.18214 0.1759 -0.09995 -0.03486
-0.02401 0.04109 0.05194 0.458 0.4146 -0.33865 -0.14335]';
xy=[0.3022;-0.2299;-0.1979;0.2915;-0.1522;-0.3322;0.2206;0.1215];
betahat=inv(xx)*xy;
gammahat=v'*betahat;
A=zeros(8,8);v2=zeros(1,8);
for k=1:8
    v2=v(k,:);
    for l=1:8
        A(k,l)=1-v2(:,l)*inv(v2*inv(d)*v2')*v2*gammahat/(d(l,l)*gammahat(l,1));
    end
end
A
B=zeros(8,8);
for m=1:8
    for n=1:8
        B(m,n)=(1-A(m,n))^2*d(n,n)*gammahat(n,1)^2;
    end
end

```

```

end
U21=sum(B(1,:))
U22=sum(B(2,:))
U23=sum(B(3,:))
U24=sum(B(4,:))
U25=sum(B(5,:))
U26=sum(B(6,:))
U27=sum(B(7,:))
U28=sum(B(8,:))
U2=[U21 U22 U23 U24 U25 U26 U27 U28]
U2m=min(U2)
mse=0.14256/(16-8-1)
F=U2m/mse
A(3,:)
a1=A(3,1);
a2=A(3,2);
a3=A(3,3);
a4=A(3,4);
a5=A(3,5);
a6=A(3,6);
a7=A(3,7);
a8=A(3,8);
A=zeros(8,8);
A(1,1)=a1;
A(2,2)=a2;
A(3,3)=a3;
A(4,4)=a4;
A(5,5)=a5;
A(6,6)=a6;
A(7,7)=a7;
A(8,8)=a8;
betatelta=v*A*gamma_hat
squares=0.14256/(16-7-1)
(diag(v*inv(d)*v'))*squares

```

(2) 加上 $a_j \in [0,1]$ 限制條件

```
format short
```

```
x=zeros(16,9);
```

```
x(:,1)=[1300;1300;1300;1300;1300;1300;1200;1200;1200;1200;1200;1200;1100;1100;1100;1100];
```

```
x(:,2)=[7.5;9.0;11.0;13.5;17.0;23.0;5.3;7.5;11.0;13.5;17.0;23.0;5.3;7.5;11.0;17.0];
```

```
x(:,3)=[0.0120;0.0120;0.0115;0.0130;0.0135;0.0120;0.0400;0.0380;0.0320;0.0260;0.0340;0.0410;0.0840;0.0980;0.0920;0.0860];
```

```
x(:,1)=(x(:,1)-(1212.5*ones(16,1)))/80.623;
```

```
x(:,2)=(x(:,2)-(12.44*ones(16,1)))/5.662;
```

```
x(:,3)=(x(:,3)-(0.0403*ones(16,1)))/0.03164;
```

```
for i=1:16
```

```
    x(i,4)=x(i,1)*x(i,2);
```

```
end
```

```
for j=1:16
```

```
    x(j,5)=x(j,1)*x(j,3);
```

```
end
```

```
for k=1:16
```

```
    x(k,6)=x(k,2)*x(k,3);
```

```
end
```

```
for l=1:16
```

```
    x(l,7)=x(l,1)^2;
```

```
end
```

```
for m=1:16
```

```
    x(m,8)=x(m,2)^2;
```

```
end
```

```
for n=1:16
```

```
    x(n,9)=x(n,3)^2;
```

```
end
```

```
x;
```

```
x1=(x(:,1)-(mean(x(:,1))*ones(16,1)))/(std(x(:,1))*sqrt(15));
```

```
x2=(x(:,2)-(mean(x(:,2))*ones(16,1)))/(std(x(:,2))*sqrt(15));
```

```
x3=(x(:,3)-(mean(x(:,3))*ones(16,1)))/(std(x(:,3))*sqrt(15));
```

```
x4=(x(:,4)-(mean(x(:,4))*ones(16,1)))/(std(x(:,4))*sqrt(15));
```

```

x5=(x(:,5)-(mean(x(:,5))*ones(16,1)))/(std(x(:,5))*sqrt(15));
x6=(x(:,6)-(mean(x(:,6))*ones(16,1)))/(std(x(:,6))*sqrt(15));
x7=(x(:,7)-(mean(x(:,7))*ones(16,1)))/(std(x(:,7))*sqrt(15));
x8=(x(:,8)-(mean(x(:,8))*ones(16,1)))/(std(x(:,8))*sqrt(15));
x9=(x(:,9)-(mean(x(:,9))*ones(16,1)))/(std(x(:,9))*sqrt(15));
x=[x1 x2 x3 x4 x5 x6 x7 x8 x9];
xx=x'*x;
xx(5,:)=[];xx(:,5)=[];
[v,d]=eig(xx);
v=fliplr(v)
d=rot90(rot90(d))
y=[0.27979 0.30583 0.31234 0.26894 0.24724 0.18214 0.1759 -0.09995 -0.03486
-0.02401 0.04109 0.05194 0.458 0.4146 -0.33865 -0.14335]';
xy=[0.3022;-0.2299;-0.1979;0.2915;-0.3322;0.2206;0.1215;0.0824];
betahat=inv(xx)*xy;
gammahat=v'*betahat;
A=zeros(8,8);v2=zeros(1,8);
A=[1 0.996964 0.994394 0.966842 0.995208 0.945377 1 0.299434
0 1 0 1 0 0 0 1
0.998831 1 1 1 1 1 1 0.949119
1 1 1 0.815511 0.947469 0.181470 0.060947 0
0 0 0 1 1 0 0 0
0 1 0 0 0 1 0 0
0.994198 0.773916 1 0.916947 0.484098 0.633418 1 1
1 0.973027 1 1 1 1 0.461390 0];
B=zeros(8,8);
for m=1:8
    for n=1:8
        B(m,n)=(1-A(m,n))^2*d(n,n)*gammahat(n,1)^2;
    end
end
end
B
U21=sum(B(1,:))
U22=sum(B(2,:))

```

```

U23=sum(B(3,:))
U24=sum(B(4,:))
U26=sum(B(5,:))
U27=sum(B(6,:))
U28=sum(B(7,:))
U29=sum(B(8,:))
U2=[U21 U22 U23 U24 U26 U27 U28 U29]
U2m=min(U2)
mse=0.14256/(16-8-1)
F=U2m/mse
A(3,:)
a1=A(3,1);
a2=A(3,2);
a3=A(3,3);
a4=A(3,4);
a5=A(3,5);
a6=A(3,6);
a7=A(3,7);
a8=A(3,8);
a=zeros(8,8);
a(1,1)=a1;
a(2,2)=a2;
a(3,3)=a3;
a(4,4)=a4;
a(5,5)=a5;
a(6,6)=a6;
a(7,7)=a7;
a(8,8)=a8;
a
betatelta=v*a*v'*betahat
squares=0.14256/(16-7-1)
variance=(diag(v*a*v'*inv(xx)*v*a*v'))*squares

```

狀況四：刪除較小 2 個特徵值的主成分、採用 M.W.G.改良方法

(1) 未加上 $a_j \in [0,1]$ 限制條件

```
format short
x=zeros(16,9);
x(:,1)=[1300;1300;1300;1300;1300;1300;1200;1200;1200;1200;1200;1200;1100;1100;1100;1100];
x(:,2)=[7.5;9.0;11.0;13.5;17.0;23.0;5.3;7.5;11.0;13.5;17.0;23.0;5.3;7.5;11.0;17.0];
x(:,3)=[0.0120;0.0120;0.0115;0.0130;0.0135;0.0120;0.0400;0.0380;0.0320;0.0260;0.0340;0.0410;0.0840;0.0980;0.0920;0.0860];
x(:,1)=(x(:,1)-(1212.5*ones(16,1)))/80.623;
x(:,2)=(x(:,2)-(12.44*ones(16,1)))/5.662;
x(:,3)=(x(:,3)-(0.0403*ones(16,1)))/0.03164;
for i=1:16
    x(i,4)=x(i,1)*x(i,2);
end
for j=1:16
    x(j,5)=x(j,1)*x(j,3);
end
for k=1:16
    x(k,6)=x(k,2)*x(k,3);
end
for l=1:16
    x(l,7)=x(l,1)^2;
end
for m=1:16
    x(m,8)=x(m,2)^2;
end
for n=1:16
    x(n,9)=x(n,3)^2;
end
x;
x1=(x(:,1)-(mean(x(:,1))*ones(16,1)))/(std(x(:,1))*sqrt(15));
```

```

x2=(x(:,2)-(mean(x(:,2))*ones(16,1)))/(std(x(:,2))*sqrt(15));
x3=(x(:,3)-(mean(x(:,3))*ones(16,1)))/(std(x(:,3))*sqrt(15));
x4=(x(:,4)-(mean(x(:,4))*ones(16,1)))/(std(x(:,4))*sqrt(15));
x5=(x(:,5)-(mean(x(:,5))*ones(16,1)))/(std(x(:,5))*sqrt(15));
x6=(x(:,6)-(mean(x(:,6))*ones(16,1)))/(std(x(:,6))*sqrt(15));
x7=(x(:,7)-(mean(x(:,7))*ones(16,1)))/(std(x(:,7))*sqrt(15));
x8=(x(:,8)-(mean(x(:,8))*ones(16,1)))/(std(x(:,8))*sqrt(15));
x9=(x(:,9)-(mean(x(:,9))*ones(16,1)))/(std(x(:,9))*sqrt(15));
x=[x1 x2 x3 x4 x5 x6 x7 x8 x9];
xx=x'*x;
xx(9,:)=[];xx(:,9)=[];
xx(7,:)=[];xx(:,7)=[];
xx(3,:)=[];xx(:,3)=[];
[v,d]=eig(xx);
v=fliplr(v)
d=rot90(rot90(d))
v(:,6)=[];
d(:,6)=[];d(6,:)=[];
y=[0.27979 0.30583 0.31234 0.26894 0.24724 0.18214 0.1759 -0.09995 -0.03486
-0.02401 0.04109 0.05194 0.458 0.4146 -0.33865 -0.14335]';
xy=[0.3022;-0.2299;0.2915;-0.1522;-0.3322;0.1215];
betahat=inv(xx)*xy;
gammahat=v'*betahat;
A=zeros(6,5);v2=zeros(1,5);
for k=1:6
    v2=v(k,:);
    for l=1:5
        A(k,l)=1-v2(:,l)*inv(v2*inv(d)*v2')*v2*gammahat/(d(l,l)*gammahat(l,1));
    end
end
A
B=zeros(6,5);
for m=1:6
    for n=1:5

```

```

        B(m,n)=(1-A(m,n))^2*d(n,n)*gammahat(n,1)^2;
    end
end
B
U41=sum(B(1,:))
U42=sum(B(2,:))
U44=sum(B(3,:))
U45=sum(B(4,:))
U46=sum(B(5,:))
U48=sum(B(6,:))
U4=[U41 U42 U44 U45 U46 U48]
U4m=min(U4)
mse=0.14256/(16-6-1)
F=U4m/mse
A(5,:)
a1=A(5,1);
a2=A(5,2);
a3=A(5,3);
a4=A(5,4);
a5=A(5,5);
A=zeros(5,5);
A(1,1)=a1;
A(2,2)=a2;
A(3,3)=a3;
A(4,4)=a4;
A(5,5)=a5;
A
betatelta=v*A*gammahat
squares=0.14256/(16-6-1)
(diag(v*inv(d)*v'))*squares

```


(2) 加上 $a_j \in [0,1]$ 限制條件

```
format short
```

```
x=zeros(16,9);
```

```
x(:,1)=[1300;1300;1300;1300;1300;1300;1200;1200;1200;1200;1200;1200;1100;1100;1100;1100];
```

```
x(:,2)=[7.5;9.0;11.0;13.5;17.0;23.0;5.3;7.5;11.0;13.5;17.0;23.0;5.3;7.5;11.0;17.0];
```

```
x(:,3)=[0.0120;0.0120;0.0115;0.0130;0.0135;0.0120;0.0400;0.0380;0.0320;0.0260;0.0340;0.0410;0.0840;0.0980;0.0920;0.0860];
```

```
x(:,1)=(x(:,1)-(1212.5*ones(16,1)))/80.623;
```

```
x(:,2)=(x(:,2)-(12.44*ones(16,1)))/5.662;
```

```
x(:,3)=(x(:,3)-(0.0403*ones(16,1)))/0.03164;
```

```
for i=1:16
```

```
    x(i,4)=x(i,1)*x(i,2);
```

```
end
```

```
for j=1:16
```

```
    x(j,5)=x(j,1)*x(j,3);
```

```
end
```

```
for k=1:16
```

```
    x(k,6)=x(k,2)*x(k,3);
```

```
end
```

```
for l=1:16
```

```
    x(l,7)=x(l,1)^2;
```

```
end
```

```
for m=1:16
```

```
    x(m,8)=x(m,2)^2;
```

```
end
```

```
for n=1:16
```

```
    x(n,9)=x(n,3)^2;
```

```
end
```

```
x;
```

```
x1=(x(:,1)-(mean(x(:,1))*ones(16,1)))/(std(x(:,1))*sqrt(15));
```

```
x2=(x(:,2)-(mean(x(:,2))*ones(16,1)))/(std(x(:,2))*sqrt(15));
```

```
x3=(x(:,3)-(mean(x(:,3))*ones(16,1)))/(std(x(:,3))*sqrt(15));
```

```

x4=(x(:,4)-(mean(x(:,4))*ones(16,1)))/(std(x(:,4))*sqrt(15));
x5=(x(:,5)-(mean(x(:,5))*ones(16,1)))/(std(x(:,5))*sqrt(15));
x6=(x(:,6)-(mean(x(:,6))*ones(16,1)))/(std(x(:,6))*sqrt(15));
x7=(x(:,7)-(mean(x(:,7))*ones(16,1)))/(std(x(:,7))*sqrt(15));
x8=(x(:,8)-(mean(x(:,8))*ones(16,1)))/(std(x(:,8))*sqrt(15));
x9=(x(:,9)-(mean(x(:,9))*ones(16,1)))/(std(x(:,9))*sqrt(15));
x=[x1 x2 x3 x4 x5 x6 x7 x8 x9];
xx=x'*x;
xx(5,:)=[];xx(:,5)=[];
[v,d]=eig(xx)
v=fliplr(v)
d=rot90(rot90(d))
v(:,7:8)=[];
d(:,7:8)=[];d(7:8,:)=[];
y=[0.27979 0.30583 0.31234 0.26894 0.24724 0.18214 0.1759 -0.09995 -0.03486
-0.02401 0.04109 0.05194 0.458 0.4146 -0.33865 -0.14335]';
xy=[0.3022;-0.2299;-0.1979;0.2915;-0.3322;0.2206;0.1215;0.0824];
betahat=inv(xx)*xy;
gammahat=v'*betahat;
A=zeros(8,6);v2=zeros(1,6);
A=[1 0 0 0 0 0
    0.259404 1 0.404814 1 0 0
    1 0 0 0 0 0
    1 1 1 0.865613 0.942449 0.679420
    0 0 0 1 1 0
    1 0.999670 1 1 1 0.907298
    0.998988 0.970854 1 0.914649 0.202609 0.797448
    0 1 0 0 0 0];
B=zeros(8,6);
for m=1:8
    for n=1:6
        B(m,n)=(1-A(m,n))^2*d(n,n)*gammahat(n,1)^2;
    end
end
end

```

```

B
U21=sum(B(1,:))
U22=sum(B(2,:))
U23=sum(B(3,:))
U24=sum(B(4,:))
U26=sum(B(5,:))
U27=sum(B(6,:))
U28=sum(B(7,:))
U29=sum(B(8,:))
U2=[U21 U22 U23 U24 U26 U27 U28 U29]
U2m=min(U2)
mse=0.14256/(16-8-1)
F=U2m/mse
A(6,:)
a1=A(6,1);
a2=A(6,2);
a3=A(6,3);
a4=A(6,4);
a5=A(6,5);
a6=A(6,6);
a=zeros(6,6);
a(1,1)=a1;
a(2,2)=a2;
a(3,3)=a3;
a(4,4)=a4;
a(5,5)=a5;
a(6,6)=a6;
a
%v=[v(1,:); v(2,:); v(3,:); v(4,:); v(5,:); v(6,:); v(7,:); v(8,:); d1];
betatelta=v*a*v'*betahat
squares=0.14256/(16-8-1)
variance=(diag(v*a*v'*inv(xx)*v*a*v'))*squares

```