

*Source Code / Program Listing for
Optimisation Programs using
MATLAB Software*

*“ This is not the end. It is not even the
beginning of the end. It is perhaps
the end of the beginning ”*

- A proverb

Coefun.m

```

function[b0,b1,b2,b3,b11,b22,b33,b12,b13,b23,b123,what,matl,b0s,b1s,b2s,b3s,b11s,b22s,b33s,b12s,b13s,b23s,b123s]=
coefun(case)
if case == 'aa',
    b0 = 4.1800;
    b1 = 1.5394;
    b2 = -1.2844;
    b3 = 1.7672;
    b11 = -0.3083;
    b22 = 0.2300;
    b33 = 0.1783;
    b12 = -0.3583;
    b13 = 0.3258;
    b23 = 0.1317;
    b123 = 0.2437;
    what = 'best accuracy';
    matl = 'Aluminum';
elseif case == 'ca',
    b0 = 5.6874;
    b1 = 2.6628;
    b2 = -1.5578;
    b3 = 1.5356;
    b11 = -0.4539;
    b22 = 0.2311;
    b33 = 0.0911;
    b12 = -0.3617;
    b13 = 0.0317;
    b23 = 0.0675;
    b123 = 0.1325;
    what = 'best accuracy';    matl = 'Copper';
elseif case == 'as',
    b0 = 1.9536;
    b1 = -0.2367;
    b2 = -0.4333;
    b3 = 0.3536;
    b11 = 0.0178;
    b22 = 0.1794;
    b33 = 0.0119;
    b12 = 0.0104;
    b13 = -0.0200;
    b23 = -0.0262;
    b123 = 0.0700;
    what = 'best surface finish';    matl = 'Aluminum';
elseif case == 'cs',
    b0 = 1.7580;
    b1 = -0.2731;
    b2 = -0.3381;
    b3 = 0.3081;
    b11 = -0.0619;
    b22 = 0.1164;
    b33 = -0.0819;
    b12 = 0.0337;
    b13 = -0.0629;
    b23 = -0.0700;
    b123 = 0.0556;
    what = 'best surface finish';    matl = 'Copper';
else
    ERROR = sprintf(' ERROR !! Given case for optimization is illegal !!\n')
    ERROR = sprintf(' !! TYPE "help funcnopt" FOR CORRECT SYNTAX !!')
    return
end

```

funcnopt.m

```

function [finmat,xopt,yopt]=funcnopt(case)
clear x1;
global b0 b1 b2 b3 b11 b22 b33 b12 b13 b23 b123
global b0s b1s b2s b3s b11s b22s b33s b12s b13s b23s b123s
[b0,b1,b2,b3,b11,b22,b33,b12,b13,b23,b123,what,matl,b0s,b1s,b2s,b3s,b11s,b22s,b33s,b12s,b13s,b23s,b123s]=coefun(
case)

i=0;
for x1=-1:1:1,
    x1
    i=i+1;
    [x2,x3,ymin]=unconx1(x1);
    x(i,:)=[x1,x2,x3];
    y(i)=ymin;
    r(i)=(14*x1)+50;
    a(i)=(2*(asin(1-(r(i)/100))))*(180/pi);
    z(i)=-1;
end
finmat = [x,y];
[vopt,j] = min(y);
xopt = x(j,:);
hold off
plot(finmat(:,1),finmat(:,4),'b-')
grid
xlabel('x1')
y_label = sprintf('%s for %s Cones (yaa)min',what,matl);
ylabel(y_label)
end

```

unconx1.m

```

function [x2opt,x3opt,ymin] = unconx1(x1)

global b0 b1 b2 b3 b11 b22 b33 b12 b13 b23 b123

global b0s b1s b2s b3s b11s b22s b33s b12s b13s b23s b123s

clear x2;
clear x3;

% Generate the x2 - x3 grid for the optimization .... grid size = 0.1 x 0.1

x2=-1.:1:1.;
x3=-1.:1:1.;
[M2,N2] = size(x2');
[M3,N3] = size(x3');

% Define the cost function y
for i=1:M2,
    for j=1:M3,
        y(i,j) = b0 + b1*x1 + b2*x2(i) + b3*x3(j);
        y(i,j) = y(i,j) + b11*(x1^2) + b22*(x2(i)^2) + b33*(x3(j)^2);
        y(i,j) = y(i,j) + b12*x1*x2(i) + b13*x1*x3(j) + b23*x2(i)*x3(j) + b123*x1*x2(i)*x3(j);
    end
end

[ycol,II] = min(y);

[ymin,JJ] =min(ycol);

x2opt=x2(II(JJ));
x3opt=x3(JJ);

end
end

```

funconx1.m

```

function []=funconx1(case,x1)
clear x2;
clear x3;
global b0 b1 b2 b3 b11 b22 b33 b12 b13 b23 b123

global b0s b1s b2s b3s b11s b22s b33s b12s b13s b23s b123s
[b0,b1,b2,b3,b11,b22,b33,b12,b13,b23,b123,what,matl,b0s,b1s,b2s,b3s,b11s,b22s,b33s,b12s,b13s,b23s,b123s]=coefun(
case)

x2=-1:1:1.;
x3=-1:1:1.;
[M2,N2] = size(x2);
[M3,N3] = size(x3);

for i=1:M2,;
    for j=1:M3,;
        y(i,j) = b0 + b1*x1 + b2*x2(i) + b3*x3(j);
        y(i,j) = y(i,j) + b11*(x1^2) + b22*(x2(i)^2) + b33*(x3(j)^2);
        y(i,j) = y(i,j) + b12*x1*x2(i) + b13*x1*x3(j) + b23*x2(i)*x3(j) + b123*x1*x2(i)*x3(j);
    end;
end;

[ycol,II] = min(y);

[ymin,JJ] =min(ycol);

x2opt=x2(II(JJ));
x3opt=x3(JJ);

mesh(x3,x2,y);
xlabel('X3');
ylabel('X2');
z_label = sprintf(' %s of %s Cones (y%s)min ',what,matl);
zlabel(z_label);
grid;
sprintf('what=%s,matl=%s,x1=%6.2f,x2opt=%6.2f,x3opt=%6.2f,ymin=%8.4f,what,matl,x1,x2opt,x3opt,ymin)
end

```

coefcon.m

```

function[b0,b1,b2,b3,b11,b22,b33,b12,b13,b23,b123,b0s,b1s,b2s,b3s,b11s,b22s,b33s,b12s,b13s,b23s,b123s,matl,curve,c
onsurmt]=coefcon(case)
if case == 'aa'
    b0 = 4.1800;
    b1 = 1.5394;
    b2 = -1.2844;
    b3 = 1.7672;
    b11 = -0.3083;
    b22 = 0.2300;
    b33 = 0.1783;
    b12 = -0.3583;
    b13 = 0.3258;
    b23 = 0.1317;
    b123 = 0.2437;
    b0s = 1.9536;
    b1s = -0.2367;
    b2s = -0.4333;
    b3s = 0.3536;
    b11s = 0.0178;
    b22s = 0.1794;
    b33s = 0.0119;
    b12s = 0.0104;
    b13s = -0.0200;
    b23s = -0.0262;
    b123s = 0.0700;
    matl = 'Aluminum'
    curve = 'Y_aa'
    constrnt = 'Y_as'
elseif case == 'ca'
    b0 = 5.6874;
    b1 = 2.6628;
    b2 = -1.5578;
    b3 = 1.5356;
    b11 = -0.4539;
    b22 = 0.2311;
    b33 = 0.0911;
    b12 = -0.3617;
    b13 = 0.0317;
    b23 = 0.0675;
    b123 = 0.1325;
    b0s = 1.7580;
    b1s = -0.2731;
    b2s = -0.3381;
    b3s = 0.3081;
    b11s = -0.0619;
    b22s = 0.1164;
    b33s = -0.0819;
    b12s = 0.0337;
    b13s = -0.0629;
    b23s = -0.0700;
    b123s = 0.0556;
    matl = 'Copper'
    curve = 'Y_ca'
    constrnt = 'Y_cs'
else
    ERROR = sprintf(' ERROR !! Given case for optimization is illegal !!\n')
    ERROR = sprintf(' !! TYPE "help funcnpt" FOR CORRECT SYNTAX !!')
    return
end

```

end

fconopt.m

```

function [finmat,xopt,yopt,ysopt]=fconopt(case,s_fin)
clear x1;
global b0 b1 b2 b3 b11 b22 b33 b12 b13 b23 b123
global b0s b1s b2s b3s b11s b22s b33s b12s b13s b23s b123s
[b0,b1,b2,b3,b11,b22,b33,b12,b13,b23,b123,b0s,b1s,b2s,b3s,b11s,b22s,b33s,b12s,b13s,b23s,b123s,matl,curve,constrmt]
=coefcon(case)
end
i=0;
for x1=-1:1:1,
    x1
    i=i+1;
    [x2,x3,ymin,ysmin]=conx1(x1,s_fin);
    x(i,:)=[x1,x2,x3];
    y(i)=ymin;
    ys(i)=ysmin;
end
finmat = [x,y',ys'];
[yopt,j] = min(y);
ysopt=ys(j);
xopt = x(j,:);
end
hold off
ll=1;
mm=1;
while mm == 1,
    if finmat(ll,4) == 10,
        ll = ll + 1;
    else
        mm = 0;
    end
end
hold off
plot (finmat(ll:size(finmat),1),finmat(ll:size(finmat),4),'b',finmat(ll:size(finmat),1),finmat(ll:size(finmat),5),'m')
hold on
plot (finmat(ll:size(finmat),1),finmat(ll:size(finmat),4),'b*',finmat(ll:size(finmat),1),finmat(ll:size(finmat),5),'mo')
grid
xlabel('x1')
y_label = sprintf('(yca)min and corresponding ycs ');
ylabel(y_label)
end

```

```

conxl.m
function [x2opt,x3opt,ymin,ysopt] = conxl(x1,s_fin)
global b0 b1 b2 b3 b11 b22 b33 b12 b13 b23 b123
global b0s b1s b2s b3s b11s b22s b33s b12s b13s b23s b123s
clear x2;
clear x3;
x2=-1:1:1;
x3=-1:1:1;
[M2,N2] = size(x2');
[M3,N3] = size(x3');
for i=1:M2,
    for j=1:M3,
        y(i,j) = b0 + b1*x1 + b2*x2(i) + b3*x3(j);
        y(i,j) = y(i,j) + b11*(x1^2) + b22*(x2(i)^2) + b33*(x3(j)^2);
        y(i,j) = y(i,j) + b12*x1*x2(i) + b13*x1*x3(j) + b23*x2(i)*x3(j) + b123*x1*x2(i)*x3(j);

        ys(i,j) = b0s + b1s*x1 + b2s*x2(i) + b3s*x3(j);
        ys(i,j) = ys(i,j) + b11s*(x1^2) + b22s*(x2(i)^2) + b33s*(x3(j)^2);
        ys(i,j) = ys(i,j) + b12s*x1*x2(i) + b13s*x1*x3(j) + b23s*x2(i)*x3(j) + b123s*x1*x2(i)*x3(j);
    end
end
end
kk = 0;
while kk == 0,

    [ycol,II] = min(y);

    [ymin,JJ] =min(ycol);

    x1opt=x1;
    x2opt=x2(II,JJ);
    x3opt=x3(JJ);

    if min(min(ys)) > s_fin,
        x2opt=10;
        x3opt=10;
        ymin=10;
        ysopt=10;
        kk=1;
    elseif ys(II,JJ) > s_fin,
        y(II,JJ) = max(max(y));
    else
        ysopt=ys(II,JJ);
        kk=1;
    end
end
end
end

```


fconx1.m

```

function [x2opt,x3opt,ymin,ysopt] = fconx1(case,x1,s_fin)

clear x2;
clear x3;
x2=-1:1:1.;
x3=-1:1:1.;
[M2,N2] = size(x2');
[M3,N3] = size(x3');
for i=1:M2,
    for j=1:M3,
        y(i,j) = b0 + b1*x1 + b2*x2(i) + b3*x3(j);
        y(i,j) = y(i,j) + b11*(x1^2 - (2/3)) + b22*(x2(i)^2 - (2/3)) + b33*(x3(j)^2 - (2/3));
        y(i,j) = y(i,j) + b12*x1*x2(i) + b13*x1*x3(j) + b23*x2(i)*x3(j) + b123*x1*x2(i)*x3(j);

        ys(i,j) = b0s + b1s*x1 + b2s*x2(i) + b3s*x3(j);
        ys(i,j) = ys(i,j) + b11s*(x1^2 - (2/3)) + b22s*(x2(i)^2 - (2/3)) + b33s*(x3(j)^2 - (2/3));
        ys(i,j) = ys(i,j) + b12s*x1*x2(i) + b13s*x1*x3(j) + b23s*x2(i)*x3(j) + b123s*x1*x2(i)*x3(j);
    end
end

kk = 0;
while kk == 0,

    [ycol,II] = min(y);

    [ymin,JJ] =min(ycol);

    x1opt=x1;
    x2opt=x2(II(JJ));
    x3opt=x3(JJ);

    if min(min(ys)) > s_fin
        x2opt=10;
        x3opt=10;
        ymin=10;
        ysopt=10;
        kk=1;
    elseif ys(II(JJ),JJ) > s_fin,
        y(II(JJ),JJ) = max(max(y));
    else
        ysopt=ys(II(JJ),JJ);
        kk=1;
    end

end

end
mesh(x3,x2,y)
xlabel('X3')
ylabel('X2')
z_label = sprintf('(y%s)min',temp)
zlabel(z_label);
grid
end

```