%set parapmeter

%please make sure in this area

%The range of the thickness should be 10

%The range of the width is 100

Fslip=15; %friction force

length=250; %distance between bolt to bolt

dbolt=22.225; %diameter of bolt

dpad=100; %diameter of the friction pad

t\_min=5; %minimum thickness of the strip

t\_max=15; %maximum thickness of the strip

w\_min=50; %minimum width of the strip

w\_max=150; %maximum width of the strip

miu = 0.4; %The friction coefficient

alpha = pi/4; %Half of the initial angle between two strip

% set the range

t1=linspace(t\_min,t\_max,100);

w1=linspace(w\_min,w\_max,100);

%create meshgrid

[t,w]=meshgrid(t1,w1);

%calculate buckling and yielding force from equation, you may add safety

%factor after the equation

Pcr=pi^2 \* 200 \* 1000 /12 .\* t .^3 .\* w /(4\*length^2)/1000 /sqrt(2) \* 2 ;

Fy=sqrt(248.22^2 ./(( 6 \* cos(alpha)\* length ./ t ./ w ./ w + sin(alpha) ./ w ./ t).^2 + 27 / 4 \* ( cos(alpha) ./ w ./ t ).^2 ))/1000 ;

% initialize Fslip matrix

for i=1:100

for j=1:100

m(i,j)=Fslip;

end

end

%-------------------------------------------------------------------

%This part draw buckling yielding and slip force in one 3D image

subplot(3,2,1)

%the last parameter is for color print, no actual meaning

mesh(t,w,Pcr,Pcr);

hold on;

mesh(t,w,Fy,Pcr-100);

hold on;

mesh(t,w,m,Pcr+100);

hold on;

xlabel('Thickness(mm)');

ylabel('width（mm)');

zlabel('Vol(mm3)');

grid on;

%--------------------------------------------------------------------

%here is for selecting feasible area (Flag(i,j)==1)

subplot(3,2,2)

%selecting feasible area

%Flag the matrix

%represent on 2D plot

for i=1:100

for j=1:100

if (Pcr(i,j)>Fslip && Fy(i,j)>Fslip) %The buckling and yielding force should be above the Slip force

Flag(i,j)=1; %Means it's feasible on this point

scatter(t\_min+10\*j/100,w\_min+100\*i/100); %mark this point on the 2D plot

hold on;

else Flag(i,j)=0; %Means this point yielding or buckling or both

end

hold on;

end

hold on;

end

xlabel('Thickness(mm)');

ylabel('width(mm)');

axis([t\_min,t\_max,w\_min,w\_max]); %set the plot in range, delete the white area

grid on;

%---------------------------------------------------------------

%Safety check, only for strip strenth,

%If not strong enough, terminate the program

%If that happens you may go back to change the range of width and

%thickness, this depends on whether there's a Flag(i,j)==1?

temp = 0;

for i=1 :100

for j=1:100

if (Flag(i,j)==1 )

temp = 1;

end

end

end

if(temp == 0) %in this case, no Flag is 1

disp('the strip is not strong enough, you may change the range');

return %here the program is terminated

end

%--------------------------------------------------------------

%this module is to compare different point in feasible area

%here we will get the minimum volume in feasible area

%And it will also return the dimension of this critical point

Volmin=10e8; %set a initial min value randomly, as it must be change in the future

for i=1:100

for j=1:100

if Flag(i,j)==1

Vol(i,j)=(t\_min+10\*j/100) \* (w\_min+100\*i/100) \* length;

if Vol(i,j)<Volmin

Volmin=Vol(i,j); imin=i; jmin=j;

end

else

Vol(i,j)=0;

end

end

end

%this is for data check because imin and jmin will be overlapped

%----------------------------------------------------------------

%iminmemo=imin

%jminmemo=jmin

%output the data

%-----------------------------------------------------------------

thickness = t\_min+10\*jmin/100; %calculate the thickness using iterater

width = w\_min+100\*imin/100; %calculate the width using iterater

volmin=Vol(imin,jmin); %retract the minimum volume from the dataset

disp ('Thickness(original):');

disp(thickness);

disp('Width(original):');

disp(width);

disp('Volume(original):')

disp(volmin);

%------------------------------------------------------

%plot Volume

subplot(3,2,3)

c=[1,0,0]; %this color control is for the red point on the critical point

meshc(t,w,Vol); %draw the volume distribution in 3D plot

hold on;

scatter3(t\_min+10\*jmin/100,w\_min+100\*imin/100,Vol(imin,jmin),15,c); %emphsize the critical point on 3D plot

xlabel('Thickness(mm)');

ylabel('width（mm)');

zlabel('Vol(mm3)');

grid on;

%-----------------------------------------------------------------

%This method modified the thickness is not right, however it's a good template

%The thickness is only available in several inch( eg 5/16'')

%set the value as the ceiling value

% remin = mod( thickness,0.5 );

% if(remin == 0)

% thickness = thickness;

% else thickness = thickness + (0.5 - remin);

% end

%

% remin=0;

%

% remin = mod( width , 5 );

% if(remin == 0)

% width = width;

% else width = width + (5 - remin);

% end

%------------------------------------------------

% Here we modified the thickness to availble value

% Please make sure the maximax thickness no more than 20

% because I didn't set function for more than 20mm thickness

if(thickness>4.765 & thickness<6.35)

thickness = 6.35;

i=1;

temp=0;

while((i<100) & (temp == 0))

if (Flag(i,ceil(10\*(6.35-t\_min))) == 1) %To find the smallest feasible width with a given thickness

temp=1; %once find, make the flag 1 to jump out the loop

end

i=i+1; %just iteritor

end

width = w\_min + i; %once jump out the loop, calculate the result with iteritor

end

%-----------------------------------------------------

%-----------------------------------------------------

if(thickness>6.35 & thickness<7.9375)

thickness1 = 6.35;

i=1;

temp=0;

while((i<100) & (temp == 0))

if (Flag(i,ceil(10\*(6.35-t\_min))) == 1) %retrack the new width on the feasible area

temp=1;

end

i=i+1;

end

width1 = w\_min + i; %width1 is the width modified by the first time

vol1=thickness1\*width1\*length; %vol1 is just used just for comparasion

if(i==100) %This case will not get the data

vol1=10e8; %so set it as a big number in order to make it lose in the later comparision

end;

thickness2 = 7.93;

i=1;

temp=0;

while((i<100) & (temp == 0))

if (Flag(i,ceil(10\*(7.93-t\_min))) == 1)

temp=1;

end

i=i+1;

end

width2 = w\_min + i; %width2 is the width modified by the first time

vol2=thickness2\*width2\*length; %vol1 is just used just for comparasion

if(vol1<vol2) %compare two colume and decide which dimension to choose

thickness=thickness1;

width=width1;

else

thickness=thickness2;

width=width2;

end

end

%------------------------------------------------------

%------------------------------------------------------

%the down part are simply repeat the first part

if(thickness>7.9375 & thickness<9.525)

thickness1 = 7.9375;

i=1;

temp=0;

while((i<100) & (temp == 0))

if (Flag(i,ceil(10\*(7.93-t\_min))) == 1)

temp=1;

end

i=i+1;

end

width1 = w\_min + i;

vol1=thickness1\*width1\*length;

if(i==100)

vol1=10e8;

end

thickness2 = 9.52;

i=1;

temp=0;

while((i<100) & (temp == 0))

if (Flag(i,ceil(10\*(9.52-t\_min))) == 1)

temp=1;

end

i=i+1;

end

width2 = w\_min + i;

vol2=thickness2\*width2\*length;

if(vol1<vol2)

thickness=thickness1;

width=width1;

else

thickness=thickness2;

width=width2;

end

end

%-----------------------------------------------

%-----------------------------------------------

if(thickness>9.525 & thickness<11.1125)

thickness1 = 9.525;

i=1;

temp=0;

while((i<100) & (temp == 0))

if (Flag(i,ceil(10\*(9.52-t\_min))) == 1)

temp=1;

end

i=i+1;

end

width1 = w\_min + i;

vol1=thickness1\*width1\*length;

if(i==100)

vol1=10e8;

end

thickness2 = 11.1125;

i=1;

temp=0;

while((i<100) & (temp == 0))

if (Flag(i,ceil(10\*(11.11-t\_min))) == 1)

temp=1;

end

i=i+1;

end

width2 = w\_min + i;

vol2=thickness2\*width2\*length;

if(vol1<vol2)

thickness=thickness1;

width=width1;

else

thickness=thickness2;

width=width2;

end

end

%-----------------------------------------------

%-----------------------------------------------

if(thickness>11.1125 & thickness<12.7)

thickness1 = 11.1125;

i=1;

temp=0;

while((i<100) & (temp == 0))

if (Flag(i,ceil(10\*(11.11-t\_min))) == 1)

temp=1;

end

i=i+1;

end

width1 = w\_min + i;

vol1=thickness1\*width1\*length;

if(i==100)

vol1=10e8;

end

thickness2 = 12.7;

i=1;temp=0;

while((i<100) & (temp == 0))

if (Flag(i,ceil(10\*(12.7-t\_min))) == 1)

temp=1;

end

i=i+1;

end

width2 = w\_min + i;

vol2=thickness2\*width2\*length;

if(vol1<vol2)

thickness=thickness1;

width=width1;

else

thickness=thickness2;

width=width2;

end

end

%-----------------------------------------------

%-----------------------------------------------

if(thickness>12.7 & thickness<14.29)

thickness1 = 12.7;

i=1;

temp=0;

while((i<100) & (temp == 0))

if (Flag(i,ceil(10\*(12.7-t\_min))) == 1)

temp=1;

end

i=i+1;

end

width1 = w\_min + i;

vol1=thickness1\*width1\*length;

if(i==100)

vol1=10e8;

end

thickness2 = 14.29;

i=1;

temp=0;

while((i<100) & (temp == 0))

if (Flag(i,ceil(10\*(14.29-t\_min))) == 1)

temp=1;

end

i=i+1;

end

width2 = w\_min + i;

vol2=thickness2\*width2\*length;

if(vol1<vol2)

thickness=thickness1;

width=width1;

else

thickness=thickness2;

width=width2;

end

end

%-----------------------------------------------

%-----------------------------------------------

if(thickness>14.29 & thickness<15.875)

thickness1 = 14.29;

i=1;

temp=0;

while((i<100) & (temp == 0))

if (Flag(i,ceil(10\*(14.29-t\_min))) == 1)

temp=1;

end

i=i+1;

end

width1 = w\_min + i;

vol1=thickness1\*width1\*length;

if(i==100)

vol1=10e8;

end

thickness2 = 15.875;

i=1;temp=0;

while((i<100) & (temp == 0))

if (Flag(i,ceil(10\*(15.875-t\_min))) == 1)

temp=1;

end

i=i+1;

end

width2 = w\_min + i;

vol2=thickness2\*width2\*length;

if(vol1<vol2)

thickness=thickness1;

width=width1;

else

thickness=thickness2;

width=width2;

end

end

%-----------------------------------------------

%-----------------------------------------------

if(thickness>15.875 & thickness<17.46)

thickness1 = 15.875;

i=1;temp=0;

while((i<100) & (temp == 0))

if (Flag(i,ceil(10\*(15.875-t\_min))) == 1)

temp=1;

end

i=i+1;

end

width1 = w\_min + i;

vol1=thickness1\*width1\*length;

if(i==100)

vol1=10e8;

end

thickness2 = 17.46;

i=1;

temp=0;

while((i<100) & (temp == 0))

if (Flag(i,ceil(10\*(17.46-t\_min))) == 1)

temp=1;

end

i=i+1;

end

width2 = w\_min + i;

vol2=thickness2\*width2\*length;

if(vol1<vol2)

thickness=thickness1;

width=width1;

else

thickness=thickness2;

width=width2;

end

end

%-----------------------------------------------

%-----------------------------------------------

if(thickness>17.46 & thickness<19.05)

thickness1 = 17.46;

i=1;temp=0;

while((i<100) & (temp == 0))

if (Flag(i,ceil(10\*(17.46 - t\_min))) == 1)

temp=1;

end

i=i+1;

end

width1 = w\_min + i;

vol1=thickness1\*width1\*length;

if(i==100) vol1=10e8; end;

thickness2 = 19.05;

i=1;temp=0;

while((i<100) & (temp == 0))

if (Flag(i,ceil(10\*(19.05 - t\_min))) == 1)

temp=1;

end

i=i+1;

end

width2 = w\_min + i;

vol2=thickness2\*width2\*length;

if(vol1<vol2)

thickness=thickness1;

width=width1;

else

thickness=thickness2;

width=width2;

end

end

%-----------------------------------------------

%-----------------------------------------------

if(thickness>19.05 & thickness<20.64)

thickness1 = 19.05;

i=1;temp=0;

while((i<100) & (temp == 0))

if (Flag(i,ceil(10\*(19.05 - t\_min))) == 1)

temp=1;

end

i=i+1;

end

width1 = w\_min + i;

vol1=thickness1\*width1\*length;

if(i==100)

vol1=10e8;

end

thickness2 = 20.64;

i=1;temp=0;

while((i<100) & (temp == 0))

if (Flag(i,ceil(10\*(20.64 - t\_min))) == 1)

temp=1;

end

i=i+1;

end

width2 = w\_min + i;

vol2=thickness2\*width2\*length;

if(vol1<vol2)

thickness=thickness1;

width=width1;

else

thickness=thickness2;

width=width2;

end

end

%-----------------------------------------------

%this is the end of comparision part

%-----------------------------------------------

%output again

%This is after modified the thickness to available size

disp ('Thickness(modified 1st):');

disp(thickness);

disp('Width(modified 1st):');

disp(width);

disp('Volume(modified 1st):')

volafter=thickness\*width\*length;

disp(volafter);

%----------------------------------------------

%here is to modified the width to a %5=0 number

remin=0;

remin = mod( width , 5 );

if(remin == 0)

width = width;

else width = width + (5 - remin);

end

disp ('Thickness (modified 2nd):');

disp(thickness);

disp('Width (modified 2nd):');

disp(width);

disp('Volume (modified 2nd):')

volafter=thickness\*width\*length;

disp(volafter); %volafter is the volume after modified 2 times

%------------------------------------------------

disp('-------------------------------');

disp('Here we will examine the modified version (1)');

radius = width/10/2; %here assuming the diameter of friction pad equals to the width of the strip

%However, must attention that it may cause problem in the later cutting

moment = Fslip \* length \* cos(alpha);

P = moment/ (2/3) /miu / radius/ 10 / 2 ; %clamping force. May be used in abaqus model to set pressure

%Attention:there are two friction pads

radius1=dpad / 2 / 10;

P1 = moment/ (2/3) /miu / radius1/ 10 / 2 ;

Pressure = P1 \* 1000 / ((dpad/10/2)^2\*pi)

V=Fslip; %shear force

Vr= 0.6 \* 0.8 \* 2 \* (dbolt/2)^2 \* pi \* 825; %shear resistance

Tr= 495 \* (dbolt/2)^2 \* pi /1000; %vertical force resistance

Pmax = pi \* radius^2 \* 3102 / 1000; %strength of the friction pad

Pbolt = 495 \* (dbolt/2)^2 \* pi /1000; %strengh of the bolt

if(Pmax<Pbolt)

disp('it depends on friction pad strength')

if (Pmax > P)

disp(Pmax);disp('>'); disp(P)

disp('The specimen passed the test' );

end

end

if(Pmax>Pbolt)

disp('it depends on bolt strength')

Pmax=Pbolt;

if ((P/(Tr))^2+(Fslip/(Vr/1000))^2 < 1)

disp((P/(Tr))^2+(Fslip/(Vr/1000))^2);disp('<'); disp(1)

disp('The specimen pass the test' );

else

disp('The bolt is not strong enough');

dbolt\_r = 2 \* (((P\*1000/495)^2+(Fslip\*1000 /0.6 / 0.8 / 2 / 825)^2)/pi/pi)^(1/4);

%Assuming equation is 1, calculate the bolt size

dbolt\_inch = dbolt\_r /25.4; %transfer to inch

%modified to n/16 inch to make it available

dbolt\_modified = floor(dbolt\_inch \* 16) + 1;

dbolt\_modified = dbolt\_modified / 16;

dbolt\_modified = dbolt\_modified \* 25.4; %back to mm

disp('the bolt should no less than:')

disp(dbolt\_modified);

min\_b = dbolt\_modified \* 1.75 \* 2; %the bolt edge requirement

if ( width < min\_b )

disp ( 'the width is too small, Im going to make the width bigger');

width =min\_b;

else

disp('the width is big enough, Just make the bolt bigger');

end

%modified Vr and Tr

Vr\_modified = 0.6 \* 0.8 \* 2 \* (dbolt\_modified/2)^2 \* pi \* 825;

Tr\_modified = 495 \* (dbolt\_modified/2)^2 \* pi /1000;

disp('In this way the equation result will be');

%check the number whether it's lower than 1

Aim\_1=(P/(Tr\_modified))^2+(Fslip/(Vr\_modified/1000))^2;

disp('the modified check number is :');

disp(Aim\_1);

end

end

%------------------------------------------------------------------------

%This is the end of rectangular optimization

%start to cut

%set parameters

b0 = width; %longer side

thetamax = atan (b0 /2 / length); %calculate maximum cutting angle

theta=linspace(0, thetamax, 100);

% This 100\*100 matrix is for explore 2 parameters, since now only explore 1

% Maybe later there will be needed to explore 2 para problem in tappered section

% ---------------------------------------------------------------------------

% [t,theta]=meshgrid(t1,theta1);

% for i=1:100

% for j=1:100

% t(i,j)=thickness;

% end

% end

%-------------------------------------

b1 = b0 - 2 \* tan (theta) \* length ; %The upper side

% Calculate the yielding forcre for all the cross-section

for i=1:100 %i controls the theta to be cut

temp=b1(i);

w=linspace(temp+0.001, b0, 100);

Fy1(i)=1e8;

for k=1:100 %k controls the distance from the top to the cross-section

side(k) = ( w(k) - temp ) /2;

dis(k) = side(k) / tan (theta(i));

Fy2(k) = sqrt( 248.22 ^ 2 /(( 6 \* cos(alpha) \* dis(k) / thickness / w(k) / w(k) + sin(alpha) / w(k) / thickness)^2 + 27 / 8 \* ( cos(alpha) / w(k) / thickness )^2 ) )/1000 ;

if(Fy2(k)<Fy1(i))

Fy1(i)= Fy2(k);

FyminWidth(i)=w(k);

%Pick up the most easily buckling cross-section

end

end

% FyminWidth

end

I0= 1 / 12 \* b0 \* thickness^ 3;

bL= 2 \* tan(theta) / b0 \* length;

para = -0.3333.\*(bL).\*(bL).\*(bL) + 0.15.\*(bL).\*(bL)-0.8117.\*(bL)+2.473; %got in curve fitting tool box

%here just remember the original data, using 3 times polynomial

%bL= [0.1 0.3 0.5 0.7 0.9];

%para=[2.393 2.235 2.062 1.865 1.621];

Pcr1 = para \* 200 \* 1000 \* I0 /(length^2) / 1000 /sqrt(2) \*2;

% set the range

%---------------------draw the rectangular specimen

subplot(3,2,4)

%here is for visional coding

%This part is for rectangular visional coding

%------------------------------------------------------------------------

%set the track to draw an cuboid

x=[0 0 width width 0 0 0 0 0 0 width width 0 width width width width];

y=[0 0 0 0 0 length length 0 0 length length length length length 0 0 length];

z=[0 thickness thickness 0 0 0 thickness thickness 0 0 0 thickness thickness thickness thickness 0 0];

%---------------this part color the image

%color every face

c = [0.7 0.7 0.7]; %set color grey

plot3(x,y,z,'k');

%the four point of each rectangular

fill3([0 0 width width],[0 0 0 0],[0 thickness thickness 0],c);

hold on;

fill3([0 0 0 0],[length length 0 0],[0 thickness thickness 0],c);

hold on;

fill3([0 width width 0],[length length length length],[0 0 thickness thickness],c);

hold on;

fill3([width width width width],[length 0 0 length],[thickness thickness 0 0],c);

hold on;

fill3([0 0 width width],[0 length length 0],[thickness thickness thickness thickness],c);

hold on;

fill3([0 0 width width],[0 length length 0],[0 0 0 0],c);

hold on;

%-------------------------------------------------------------

axis([0,width,0,length,0,thickness]); %delete white area

axis equal;

%-------------------------------------------------

%-------------------------------------------------------------------

subplot(3,2,5)

%-------------------------------------

%no longer use 2D matrix

% mesh(t,theta,Pcr,Pcr);

% hold on;

% mesh(t,theta,Fy,Pcr-100);

% hold on;

% mesh(t,theta,m,Pcr+100);

% hold on;

%--------------------------------------

for i=1:100

m(i)=Fslip;

end

%This is for 2D drawing

theta=theta/pi\*180; %tansfer theta into degree units

plot(theta,Pcr1,'k');

hold on;

plot(theta,Fy1,'r'); %Yielding force

hold on;

plot(theta,m,'y'); %Buckling force

hold on;

legend('Buckling','Yielding','Fslip');

xlabel('theta（o)');

ylabel('Force(KN)');

grid on;

%------------------------------------------------

%------------------------------------------------

%initialize Flag1(i) which is different from Flag as a 100\*100 matrix

for i=1:100

Flag1(i)=1;

end

%use matrix to mark the buckling and yielding condition, if fail keep 0

%The 100\*1 matrix cannot overlap 100\*100 matrix so Flag1 is re-defined

%if not fail, set Flag as 1

for i=1:100

if (Pcr1(i)>Fslip && Fy1(i)>Fslip)

Flag1(i)=0;

end

end

temp = 0;

%here retract the maximum theta that can be cut

i=2;

%because i=1 is a strange value and should not be considerated

while((i<100) & (temp == 0))

if (Flag1(i) == 1)

temp=1;

%once find, set temp as 1 in order to jump out the loop

imin=i;

end

i=i+1;

%i++ the iterator

end

thetamin = thetamax\*imin/100;

a1=b0-2\*length\*tan(thetamin);

V\_56 = 0.6 \* 0.8 \* 2 \* 1 \*7.94 ^2 \* pi \* 825 /1000; %Vr of (5/8)'' diameter bolt in the short end

%--------------------------------------------------------------------

%check the short side bolt shear strength

if(V\_56 < Fslip)

disp('the bolt size needs to be changed');

%use Vr as the Fslip to get the minimum bolt size in the short end

dbolt1 = 2 \* sqrt(Fslip \* 1000 /(0.6 \* 0.8 \* 2 \* 1 \* pi \* 825));

disp('the new diameter of bolt should no less than');

disp(dbolt1);

%------------------------------

%here will modified the diameter to available value

dbolt1 = dbolt1 /25.4;

dbolt1 = ceil(dbolt1 \* 16);

dbolt1 = dbolt1 / 16;

dbolt1 = dbolt1 \* 25.4;

edge\_min = 1.75 \* 2 \* dbolt1;

%-----------------------------------------------

%here will check the shear capacity of the strip

Br=3 \* 0.8 \* 1 \* thickness \* dbolt1 \* 825 /1000;

if(Br<Fslip)

disp('strip will fail(Br)');

end

%check end

%------------------------------------------------

if(a1<edge\_min) %here we may cut too much

disp('the upper edge depends on bolt size')

Volmin=(edge\_min+b0)\*length/2\*thickness;

%here because of changing bolt, the edge should not be 56

disp('theta(original):');

disp(atan((b0-edge\_min)/2/length)/pi\*180);

disp('Volume(original):');

disp(Volmin);

subplot(3,2,6)

a0=width;

a1=edge\_min;

%-----------------------------visualize coding

s=(a0-edge\_min)/2;

x=[0 0 a0 a0 0 0 s s 0 s s+a1 s+a1 s s+a1 a0 a0 s+a1];

y=[0 0 0 0 0 0 length length 0 length length length length length 0 0 length];

z=[0 thickness thickness 0 0 thickness thickness 0 0 0 0 thickness thickness thickness thickness 0 0];

plot3(x,y,z,'k');

axis([0,width,0,length,0,thickness]);

axis equal;

%--------------this part is to color the image

fill3([0 0 a0 a0],[0 0 0 0],[0 thickness thickness 0],c);

hold on;

fill3([0 s s 0],[0 length length 0],[thickness thickness 0 0],c);

hold on;

fill3([0 s s 0],[0 length length 0],[thickness thickness 0 0],c);

hold on;

fill3([s s+a1 s+a1 s],[length length length length],[0 0 thickness thickness],c);

hold on;

fill3([s+a1 a0 a0 s+a1],[length 0 0 length],[thickness thickness 0 0],c);

hold on;

fill3([0 s s+a1 a0],[0 length length 0],[thickness thickness thickness thickness],c);

hold on;

fill3([0 s s+a1 a0],[0 length length 0],[0 0 0 0],c);

hold on;

axis([0,width,0,length,0,thickness]);

axis equal;

disp('the up side is ');

disp(a1);

end

%---------------------------------------

if(a1>edge\_min) %just use theta which we calculate to cut

Volmin=(2\*b0-2\*length\*tan(thetamin)) \* length / 2 \* thickness;

disp('theta(original):');

disp(thetamin/pi\*180);

disp('Volume(original):')

disp(Volmin);

subplot(3,2,6)

a0=width;

a1=b0-2\*length\*tan(thetamin);

s=(a0-a1)/2;

%visualize coding-------------------------------------------------

x=[0 0 a0 a0 0 0 s s 0 s s+a1 s+a1 s s+a1 a0 a0 s+a1];

y=[0 0 0 0 0 0 length length 0 length length length length length 0 0 length];

z=[0 thickness thickness 0 0 thickness thickness 0 0 0 0 thickness thickness thickness thickness 0 0];

plot3(x,y,z,'k');

axis([0,width,0,length,0,thickness]);

axis equal;

%--------------this part is to color the image

fill3([0 0 a0 a0],[0 0 0 0],[0 thickness thickness 0],c);

hold on;

fill3([0 s s 0],[0 length length 0],[thickness thickness 0 0],c);

hold on;

fill3([0 s s 0],[0 length length 0],[thickness thickness 0 0],c);

hold on;

fill3([s s+a1 s+a1 s],[length length length length],[0 0 thickness thickness],c);

hold on;

fill3([s+a1 a0 a0 s+a1],[length 0 0 length],[thickness thickness 0 0],c);

hold on;

fill3([0 s s+a1 a0],[0 length length 0],[thickness thickness thickness thickness],c);

hold on;

fill3([0 s s+a1 a0],[0 length length 0],[0 0 0 0],c);

hold on;

axis([0,width,0,length,0,thickness]);

axis equal;

disp('the up side is ');

disp(a1);

end

%-------------------------------------------------

elseif(V\_56 > Fslip && a1 < 56) %(5/8)'' diameter bolt is enough and we cut too much

%not meet the steel structure code

%These two data has no actual meaning, just for test

width\_memo = a1;

angle\_memo = atan((b0-a1)/2/length)/pi\*180;

disp('the upper edge depends on bolt size')

Volmin=(56+b0)\*length/2\*thickness;

disp('theta(original):');

disp(atan((b0-56)/2/length)/pi\*180);

disp('Volume(original):')

disp(Volmin);

subplot(3,2,6)

%------------------------------------------------

%always check the Br

Br=3 \* 0.8 \* 1 \* thickness \* 15.875 \* 825 /1000;

if(Br<Fslip)

disp('strip will fail(Br)');

end

%----------------------------------------------

%initialize

a0=width;

a1=56;

s=(a0-56)/2;

%visualize coding

x=[0 0 a0 a0 0 0 s s 0 s s+a1 s+a1 s s+a1 a0 a0 s+a1];

y=[0 0 0 0 0 0 length length 0 length length length length length 0 0 length];

z=[0 thickness thickness 0 0 thickness thickness 0 0 0 0 thickness thickness thickness thickness 0 0];

plot3(x,y,z,'k');

axis([0,width,0,length,0,thickness]);

axis equal;

%--------------this part is to color the image

fill3([0 0 a0 a0],[0 0 0 0],[0 thickness thickness 0],c);

hold on;

fill3([0 s s 0],[0 length length 0],[thickness thickness 0 0],c);

hold on;

fill3([0 s s 0],[0 length length 0],[thickness thickness 0 0],c);

hold on;

fill3([s s+a1 s+a1 s],[length length length length],[0 0 thickness thickness],c);

hold on;

fill3([s+a1 a0 a0 s+a1],[length 0 0 length],[thickness thickness 0 0],c);

hold on;

fill3([0 s s+a1 a0],[0 length length 0],[thickness thickness thickness thickness],c);

hold on;

fill3([0 s s+a1 a0],[0 length length 0],[0 0 0 0],c);

hold on;

axis([0,width,0,length,0,thickness]);

axis equal;

disp('the up side is ');

disp(a1);

%thetamino=thetamin\*180/pi;

%-----------------------------------------------------------------

else(V\_56 > Fslip && a1 > 56) %(5/8)'' bolt is enough and meet the code

%just cut as it calculates

Volmin=(2\*b0-2\*length\*tan(thetamin)) \* length / 2 \* thickness;

disp('theta(original):');

disp(thetamin/pi\*180);

disp('Volume(original):')

disp(Volmin);

Br=3 \* 0.8 \* 1 \* thickness \* 15.875 \* 825 /1000;

if(Br<Fslip)

disp('strip will fail(Br)');

end

subplot(3,2,6)

a0=width;

a1=b0-2\*length\*tan(thetamin);

s=(a0-a1)/2;

x=[0 0 a0 a0 0 0 s s 0 s s+a1 s+a1 s s+a1 a0 a0 s+a1];

y=[0 0 0 0 0 0 length length 0 length length length length length 0 0 length];

z=[0 thickness thickness 0 0 thickness thickness 0 0 0 0 thickness thickness thickness thickness 0 0];

plot3(x,y,z,'k');

axis([0,width,0,length,0,thickness]);

axis equal;

%--------------this part is to color the image

fill3([0 0 a0 a0],[0 0 0 0],[0 thickness thickness 0],c);

hold on;

fill3([0 s s 0],[0 length length 0],[thickness thickness 0 0],c);

hold on;

fill3([0 s s 0],[0 length length 0],[thickness thickness 0 0],c);

hold on;

fill3([s s+a1 s+a1 s],[length length length length],[0 0 thickness thickness],c);

hold on;

fill3([s+a1 a0 a0 s+a1],[length 0 0 length],[thickness thickness 0 0],c);

hold on;

fill3([0 s s+a1 a0],[0 length length 0],[thickness thickness thickness thickness],c);

hold on;

fill3([0 s s+a1 a0],[0 length length 0],[0 0 0 0],c);

hold on;

axis([0,width,0,length,0,thickness]);

axis equal;

disp('the up side is ');

disp(a1);

end

%-------------------------------------------------

%Last Brcheck