Assignment # 1
Stress Analysis
(ME-419)

Submitted to: Sir Shaukat Ali

Group Members:

Muhammad Abeer Khan (ME-19221)

Muhammad Asher (ME-19304)

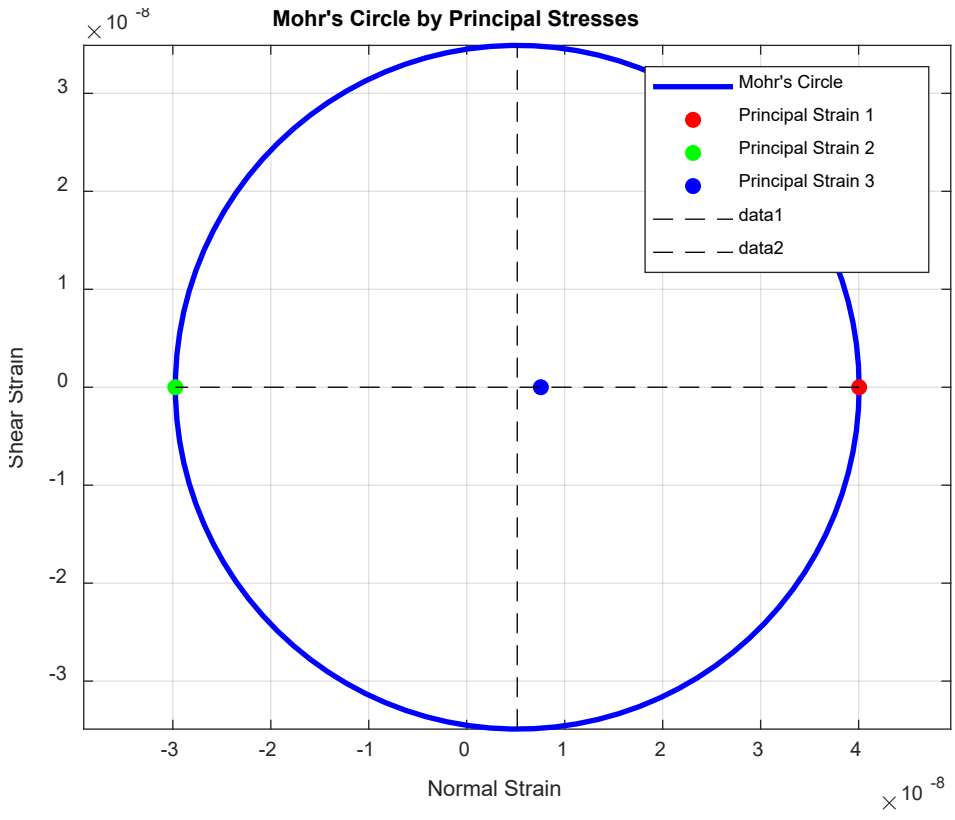
Stress Analysis (Assignment # 1)

Matlab Code:

```
clc,clearvars
fprintf("Muhammad Abeer Khan ME-19221\n")
fprintf("Muhammad Asher      ME-19304")
%stress converted to principal stresses then to principal strains
E=29e8
v=0.26
sigx_x=90;
sigy_y=54;
sigz_z=-36;
taux_y=27;
tauy_z=-15;
taux_z=-36;

i_1=sigx_x+sigy_y+sigz_z;
i_2=sigx_x*sigy_y+sigy_y*sigz_z+sigz_z*sigx_x-taux_y^2-tauy_z^2-taux_z^2;
i_3=sigx_x*sigy_y*sigz_z-sigx_x*tauy_z^2-sigy_y*taux_z^2-
sigz_z*taux_y^2+2*taux_y*tauy_z*taux_z;

p=[1 -i_1 i_2 -i_3];
r=roots(p);
%tau_max=(max(r)-min(r))/2

e_1=(1/E)*(r(1,:)-v*(r(2,:)+r(3,:)))
e_2=(1/E)*(r(2,:)-v*(r(1,:)+r(3,:)))
e_3=(1/E)*(r(3,:)-v*(r(2,:)+r(1,:)))

% Mohr circle
% the center and radius of the Mohr's circle
center = (e_1 + e_2) / 2;
radius = abs(e_1 - e_2) / 2;
theta = linspace(0, 2*pi, 100);

% coordinates of the Mohr's circle
x = center + radius * cos(theta);
y = radius * sin(theta);

figure;
plot(x, y, 'b', 'LineWidth', 2);
hold on;

% principal strains
scatter(e_1, 0, 'r', 'filled');
scatter(e_2, 0, 'g', 'filled');
scatter(e_3, 0, 'b', 'filled');

xlabel('Normal Strain');
ylabel('Shear Strain');
title('Mohr''s Circle by Principal Stresses');
grid on;
axis equal;
legend('Mohr''s Circle', 'Principal Strain 1', 'Principal Strain 2', 'Principal
Strain 3');

% Mark the axis with dashed lines
plot([center, center], [-radius, radius], 'k--'); % Vertical dashed line
plot([e_1, e_2], [0, 0], 'k--'); % Horizontal dashed lines
```

Command Window:

```
Muhammad Abeer Khan ME-19221
Muhammad Asher      ME-19304
E =

   2.9000e+09


v =

    0.2600


e_1 =

   4.0055e-08


e_2 =

  -2.9743e-08


e_3 =

   7.5632e-09
```

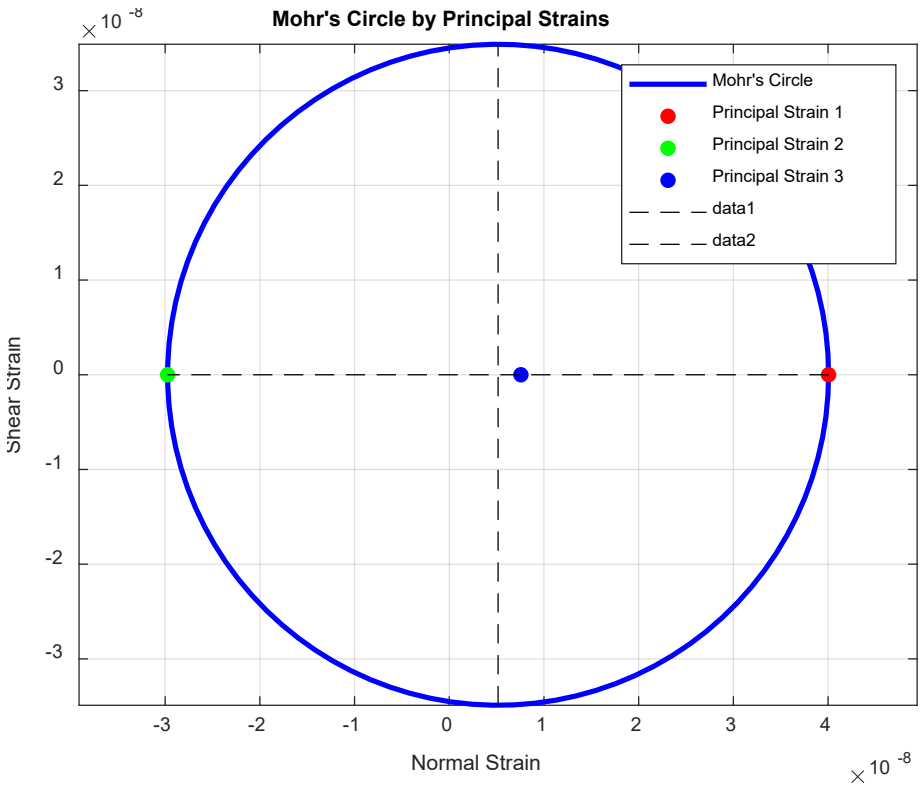


Matlab Code:

```
clc,clearvars
fprintf("Muhammad Abeer Khan ME-19221\n")
fprintf("Muhammad Asher      ME-19304")
%Stresses converted to strains then to principal strains
E=29e8
v=0.26
sigx_x=90;
sigy_y=54;
sigz_z=-36;
taux_y=27;
tauy_z=-15;
taux_z=-36;

ex_x=(1/E)*(sigx_x-v*(sigy_y+sigz_z))
ey_y=(1/E)*(sigy_y-v*(sigx_x+sigz_z))
ez_z=(1/E)*(sigz_z-v*(sigy_y+sigx_x))

gx_y=2*(1+v)*taux_y/E
gy_z=2*(1+v)*tauy_z/E
gx_z=2*(1+v)*taux_z/E

J_1=ex_x+ey_y+ez_z;
J_2=ex_x*ey_y+ey_y*ez_z+ez_z*ex_x-(1/4)*(gx_y^2+gy_z^2+gx_z^2);
J_3=ex_x*ey_y*ez_z+(1/4)*(-ex_x*gy_z^2-ey_y*gx_z^2-ez_z*gx_y^2+gx_y*gy_z*gx_z);

p=[1 -J_1 J_2 -J_3];
r=roots(p);

e_1=r(1,:)
e_2=r(2,:)
e_3=r(3,:)

% Mohr circle
% the center and radius of the Mohr's circle
center = (e_1 + e_2) / 2;
radius = abs(e_1 - e_2) / 2;
theta = linspace(0, 2*pi, 100);

% coordinates of the Mohr's circle
x = center + radius * cos(theta);
y = radius * sin(theta);

figure;
plot(x, y, 'b', 'LineWidth', 2);
hold on;

% principal strains
scatter(e_1, 0, 'r', 'filled');
scatter(e_2, 0, 'g', 'filled');
scatter(e_3, 0, 'b', 'filled');

xlabel('Normal Strain');
ylabel('Shear Strain');
title('Mohr''s Circle by Principal Strains');
grid on;
axis equal;
legend('Mohr''s Circle', 'Principal Strain 1', 'Principal Strain 2', 'Principal
Strain 3');


% Mark the axis with dashed lines
plot([center, center], [-radius, radius], 'k--'); % Vertical dashed line
plot([e_1, e_2], [0, 0], 'k--'); % Horizontal dashed lines
```

Command Window:

```
Muhammad Abeer Khan ME-19221
Muhammad Asher      ME-19304
E =

   2.9000e+09

v =

    0.2600

ex_x =

   2.9421e-08

ey_y =

   1.3779e-08

ez_z =

  -2.5324e-08

gx_y =

   2.3462e-08

gy_z =

  -1.3034e-08

gx_z =

  -3.1283e-08

e_1 =

   4.0055e-08

e_2 =

  -2.9743e-08

e_3 =

   7.5632e-09
```



Conclusion

The first code transforms stress into strain and yields Principal strain. The second code transforms stresses into principal stresses and yields Principal strains. Two separate codes were written in order to verify the results.