A screenshot of a computer program

Description automatically generated

close all; clear, clc, format shortG

% AerE 421 HW2 Logan Wessel

% HW2

%% Q1

fprintf("Q1\n")

% a

fprintf("Q1.a\n")

f\_x = 0; % N

f\_z = 12000; % N

f\_y = 500; % N

M\_x = f\_z \* 0.5; % Nm

M\_y = -f\_z \* 5; % Nm

M\_z = f\_y \* 5; % Nm

fprintf("M\_x = %.6g Nm\n", M\_x)

fprintf("M\_y = %.6g Nm\n", M\_y)

fprintf("M\_z = %.6g Nm\n", M\_z)

% b

fprintf("\nQ1.b\n")

A = [1 1 5 1 5 1] / 100^2; % m^2

y = [2.5 1.5 .5 0 .5 1.5]; % m

z = [0 -.0625 -0.125 0 .125 .0625]; % m

y\_bar = sum(A.\*y) / sum(A); % m

z\_bar = 0; % m

fprintf("y\_bar = %.6g m\n", y\_bar)

fprintf("z\_bar = %.6g m\n", z\_bar)

% c

fprintf("\nQ1.c\n")

I\_y = sum(A .\* (z - z\_bar).^2); % m^4

I\_z = sum(A .\* (y - y\_bar).^2); % m^4

I\_yz = sum(A .\* (y - y\_bar) .\* (z - z\_bar)); % m^4

fprintf("I\_y = %.6g m^4\n", I\_y)

fprintf("I\_z = %.6g m^4\n", I\_y)

fprintf("I\_yz = %.6g m^4\n", I\_y)

% d

fprintf("\nQ1.d\n")

sigma = (-((I\_y \* M\_z + I\_yz \* M\_y) / (I\_y \* I\_z - I\_yz^2)) \* (y - y\_bar)) + (((I\_z \* M\_y + I\_yz \* M\_z) / (I\_y \* I\_z - I\_yz^2)) \* (z - z\_bar)); % Pa

for i = 1:length(sigma)

if sigma(i) > 0

fprintf("sigma %d = %.6g Pa [T]\n", i, sigma(i))

else

fprintf("sigma %d = %.6g Pa [C]\n", i, sigma(i))

end

end

%% Q2

fprintf("\nQ2\n")

% a

S\_z = 5000; % N at shear center

A = [.5 1 .5 .5 1] / 100^2; % m^2

y = [0 500 2500 2500 500] / 1000; % m

z = [0 -100 -25 25 100] / 1000; % m

y\_bar = sum(A .\* y) / sum(A); % m

z\_bar = 0; % m

fprintf("y\_bar = %.6g m\n", y\_bar)

fprintf("z\_bar = %.6g m\n", z\_bar)

I\_y = sum(A .\* (z - z\_bar).^2); % m^4

I\_z = sum(A .\* (y - y\_bar).^2); % m^4

I\_yz = sum(A .\* (y - y\_bar) .\* (z - z\_bar)); % m^4

fprintf("I\_y = %.6g m^4\n", I\_y)

fprintf("I\_z = %.6g m^4\n", I\_y)

fprintf("I\_yz = %.6g m^4\n", I\_y)

fprintf("\nQ2.a\n")

q45 = + (S\_z / I\_y) \* A(4) \* (z(4) - z\_bar); % N/m

q51 = q45 + (S\_z / I\_y) \* A(5) \* (z(5) - z\_bar); % N/m

q12 = q51 + (S\_z / I\_y) \* A(1) \* (z(1) - z\_bar); % N/m

q23 = q12 + (S\_z / I\_y) \* A(2) \* (z(2) - z\_bar); % N/m

q34 = q23 + (S\_z / I\_y) \* A(3) \* (z(3) - z\_bar); % N/m

fprintf("q45 = %.6g N/m\n", q45)

fprintf("q51 = %.6g N/m\n", q51)

fprintf("q12 = %.6g N/m\n", q12)

fprintf("q23 = %.6g N/m\n", q23)

fprintf("q34 = %.6g N/m\n", q34)

%b

fprintf("\nQ2.b\n")

zeta = (-(2 \* (.5 \* .5 \* .2) \* q12) + (2 \* (.5 \* 2 \* 200) \* q23)) / S\_z; % mm

fprintf("zeta = %.6g mm\n", zeta)

%% Q3

fprintf("\nQ3\n")

% a

fprintf("\nQ3.a\n")

A = [1.5, 2, 1.5, 2] / 100^2; % m^2

t = 1 / 1000; % m

G = 27 \* 10^9; % Pa

V\_z = 2000; % N

% (2000 / G) \* (2 / 100^2) \* (40 / 1000) = 5.9259e-13

% q41 = q34 - (2000 / G) \* (A(4)) \* (40 / 1000) = q34 - 5.9259e-13 V\_z N/m

% q12 = q34 - (5.9259e-13 \* V\_z) - (2000 / G) \* (A(1)) \* (0 / 1000) = q34 - 5.9259e-13 N/m

% (2000 / G) \* (A(2)) \* (-40 / 1000) = -5.9259e-13 V\_z

% q23 = q34 - (5.9259e-13 \* v\_z) - (2000 / G) \* (A(2)) \* (-40 / 1000) = q34 - 5.9259e-13 + 5.9259e-13 = q34 N/m

% q34 = q34 - (2000 / G) (A(3)) \* (0 / 1000) = q34 N/m

M\_1 = 2000 \* (40 / 1000); % Nm

% 2000 \* (40 / 1000) = 80

% M\_1 = (2 \* Q12 \* (.25 \* (pi \* .04^2))) + (2 \* q23 \* (.5 \* .04 \* .34)) + (2 \* q34 \* (.5 \* .04 \* .34))

% M\_1 = (2 \* (q34 - 5.9259e-13) \* (.25 \* (pi \* .04^2))) + (2 \* (q34) \* (.5 \* .04 \* .34)) + (2 \* q34 \* (.5 \* .04 \* .34))

% 80 = (2 \* (q34 - 5.9259e-13) \* (.25 \* (pi \* .04^2))) + (2 \* (q34) \* (.5 \* .04 \* .34)) + (2 \* q34 \* (.5 \* .04 \* .34))

q34 = 40 / ((1 - (2000 / G) \* (A(4)) \* (40 / 1000)) \* (.25 \* (pi \* .04^2)) + (.5 \* .04 \* .34) + (.5 \* .04 \* .34)); % N/m

q41 = q34 - (2000 / G) \* (A(4)) \* (40 / 1000);

q12 = q34 - (5.9259e-13 \* V\_z) - (2000 / G) \* (A(1)) \* (0 / 1000);

q23 = q34 - (5.9259e-13 \* V\_z) - (2000 / G) \* (A(2)) \* (-40 / 1000);

fprintf("q34 = %.6g N/m\n", q34)

fprintf("q41 = %.6g N/m\n", q41)

fprintf("q12 = %.6g N/m\n", q12)

fprintf("q23 = %.6g N/m\n", q23)