
```

clear all;
clc
% You can do all at once. But I just like it this way for now
file = readmatrix("aluminum_3_point.txt"); % out the specimen data
% you want %\file = readmatrix("specimen1.txt");
file2 = readmatrix("aluminum_4_point.txt");
Area = 1472.59; % [mm^2]

% now create the variable for strain 3 points load
time1 = file(:,1); %[s]
MTSforce1 = -file(:,2); %[N]
MTSdisp1 = file(:,3); %[mm]
LD1 = file(:,4); %[mm]
SG11 = -1*file(:,6); %[mm/mm]
SG21 = -1*file(:,5); %[mm/mm]
SG31 = -1*file(:,7); %[mm/mm]
SG451 = -file(:,8); %[mm/mm]
ActualLD1 = -1*file(:,9); %[mm/mm]

% using picture, we will also have the follow for 3 points bending.
picLD1 = -1*[0.06635, -0.094508, -0.129403, -0.122613, -0.355676,
-0.550519, -0.742947, -0.895336]';
pic11 = -1*[0, -0.000220618, -0.000223732, -0.000119214,
-0.0001179182, -0.00010797964, -0.00010595612, -0.0001344236]';
pic21 = -1*[0, -0.0002501, -0.000323736, -0.000207743, -0.00023669,
-0.000276908, -0.000354158, -0.000406692]';
pic31 = -1*[0, -0.000307732, -0.000326346, -0.000270148, -0.000319308,
-0.000431834, -0.000492094, -0.000594886]';
pic451 = -1*[0, 0.00004113916, 0.0000235116, 0.00001933302,
-0.000061958, -0.0000570436, -0.000137936, -0.000177588]';
force1 = -1*[45.822726, -449.56334, -1466.527103, -3547.833426,
-6433.258865, -9514.160002, -12690.38897, -15915.71075]';
% now create variable for 4 points load
time2 = file2(:,1); %[s]
MTSforce2 = -file2(:,2); %[N]
MTSdisp2 = file2(:,3); %[mm]
LD2 = file2(:,4); %[mm]
SG12 = -file2(:,6); %[mm/mm]
SG22 = -file2(:,5); %[mm/mm]
SG32 = -file2(:,7); %[mm/mm]
SG452 = -file2(:,8); %[mm/mm]
ActualLD2 = -file2(:,9); %[mm/mm]

% using picture, we will also have the follow for 4 points bending.
picLD2 = -1*[0.158717, -0.104026, -0.322249, -0.450453, -0.452343,
-0.520697, -0.517687, -0.426023, -0.502742, -0.419373, -0.534977]';
pic12 = -1*[0, -0.000554054, -0.00073228, -0.001026094, -0.001046134,
-0.0010805, -0.00120797, -0.001150464, -0.001083736, -0.00122678,
-0.00123052]';
pic22 = -1*[0, -0.0006596, -0.00097684, -0.00131908, -0.00140994,
-0.00152646, -0.00167052, -0.00167098, -0.00171792, -0.00166962,
-0.0017422]';

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pic32 = -1*[0, -0.000786818, -0.001237, -0.00136022, -0.00162358,
    -0.00169236, -0.001759, -0.00196852, -0.00186584, -0.0020953,
    -0.00209964]';
pic452 = [0, 0.0003866792, 0.0000690874, 0.0008556088, 0.0001613134,
    0.000283604, 0.0001064004, 0.0001017156, 0.0001903126, 0.000198518,
    0.0000994292];
force2 = -1*[22.05976, -229.564695, -1114.590972, -2240.011095,
    -3155.066707, -4618.697248, -6512.786438, -8762.008011, -11999.31326,
    -15092.02309, -18577.11328]';
%draw line of best fit for 3 points bending
coef11 = polyfit(ActualLD1, SG11, 1);
coef21 = polyfit(ActualLD1, SG21, 1);
coef31 = polyfit(ActualLD1, SG31, 1);
dis1 = linspace(0, max(ActualLD1), 1000);
yFit1 = polyval(coef11, dis1);
yFit2 = polyval(coef21, dis1);
yFit3 = polyval(coef31, dis1);

% draw the line of best fit for the 3 points bending using the NCORR
piccoe11 = polyfit(picLD1, pic11,1);
piccoe21 = polyfit(picLD1, pic21,1);
piccoe31 = polyfit(picLD1, pic31,1);
dispic1 = linspace(0, max(picLD1), 1000);
ypic11 = polyval(piccoe11, dispic1);
ypic21 = polyval(piccoe21, dispic1);
ypic31 = polyval(piccoe31, dispic1);

%draw the line of best fit for 4 points bending
coef12 = polyfit(ActualLD2, SG12, 1);
coef22 = polyfit(ActualLD2, SG22, 1);
coef32 = polyfit(ActualLD2, SG32, 1);
dis2 = linspace(0, max(ActualLD2), 1000);
yFit12 = polyval(coef12, dis2);
yFit22 = polyval(coef22, dis2);
yFit32 = polyval(coef32, dis2);

% find stress for 3 points bending
figure(1);
plot(ActualLD1,SG11,'-o');
hold on
plot(ActualLD1,SG21,'-o');
hold on
plot(ActualLD1,SG31,'-o');
hold on
plot(picLD1, pic11,'-o')
hold on
plot(picLD1, pic21,'-o')
hold on
plot(picLD1, pic31,'-o')
% hold on
% plot(dis1, yFit1, 'k-');
% hold on
% plot(dis1, yFit2, 'k-');

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% hold on
% plot(dis1, yFit3, 'k-');
% hold on %
% plot(dispic1, ypic11 , 'k-');%
% hold on %
% plot(dispic1, ypic21 , 'k-');%
% hold on %
% plot(dispic1, ypic31 , 'k-');%
legend({'Strain Gauge 1 (5 mm)', 'Strain Gauge 2 (19 mm)', 'Strain
    Gauge 3 (38 mm)', 'NCORR Strain at 5 mm', 'NCORR Strain at 19
    mm', 'NCORR Strain at 27.5 mm'}, 'Location', 'northwest')
xlabel('Displacement [mm]')
ylabel('Strain')
title('Strain vs Displacement for 3 Points Bending')
hold off

% find stress for 4 points bending
figure(2)
plot(ActualLD2, SG12, '-o');
hold on
plot(ActualLD2, SG22, '-o');
hold on
plot(ActualLD2, SG32, '-o');
hold on
plot(picLD2, pic12, '-o');
hold on
plot(picLD2, pic22, '-o');
hold on
plot(picLD2, pic32, '-o');
% plot(dis2, yFit12, 'k-');
% hold on
% plot(dis2, yFit22, 'k-');
% hold on
% plot(dis2, yFit32, 'k-');
legend({'Strain Gauge 1 (5 mm)', 'Strain Gauge 2 (19 mm)', 'Strain
    Gauge 3 (38 mm)', 'NCORR Strain at 5 mm', 'NCORR Strain at 19
    mm', 'NCORR Strain at 27.5 mm'}, 'Location', 'northwest')
xlabel('Displacement [mm]')
ylabel('Strain')
title('Strain vs Displacement for 4 points bending')
hold off

% shear strain can be calculate from 2* strain gauge at 45 degree
shear1 = 2*SG451;
shear2 = 2*SG452;
%shear force using pic
shearpic1 = 2*pic451;
shearpic2 = 2*pic452;

% we will plot the shear strain vs stress.
figure(3)
plot(MTSforc1, shear1, '-o');
hold on
plot(forc1, shearpic1, '-o')

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xlabel('Force [N]');
ylabel('Shear Strain');
title('Force vs strain for 3 points bending')
hold off

figure(4)
plot(MTSforce2, shear2, '-o');
hold on
plot(force2, shearpic2, '-o');
xlabel('Force [N]');
ylabel('Shear Strain');
title('Force vs strain for 4 points bending')
hold off

%strain vs force
figure(5);
plot(MTSforce1, SG11);
hold on
plot(MTSforce1, SG21);
hold on
plot(MTSforce1, SG31);
hold on
plot(force1, pic11, '-o');
hold on
plot(force1, pic21, '-o');
hold on
plot(force1, pic31, '-o');
legend({'Strain Gauge 1', 'Strain Gauge 2', 'Strain Gauge 3', 'height
5', 'height 19', 'height 27.5'}, 'Location', 'northwest')
xlabel('Force')
ylabel('Strain')
title('Force vs Strain for 3 points bending')
hold off

figure(6);
plot(MTSforce2, SG12);
hold on
plot(MTSforce2, SG22);
hold on
plot(MTSforce2, SG32);
hold on
plot(force2, pic12, '-o');
hold on
plot(force2, pic22, '-o');
hold on
plot(force2, pic32, '-o');
legend({'Strain Gauge 1', 'Strain Gauge 2', 'Strain Gauge 3', 'height
5', 'height 19', 'height 27.5'}, 'Location', 'northwest')
xlabel('force')
ylabel('Strain')
title('Force vs Strain for 4 points bending')
hold off

% Now plot the strain at 90 seconds

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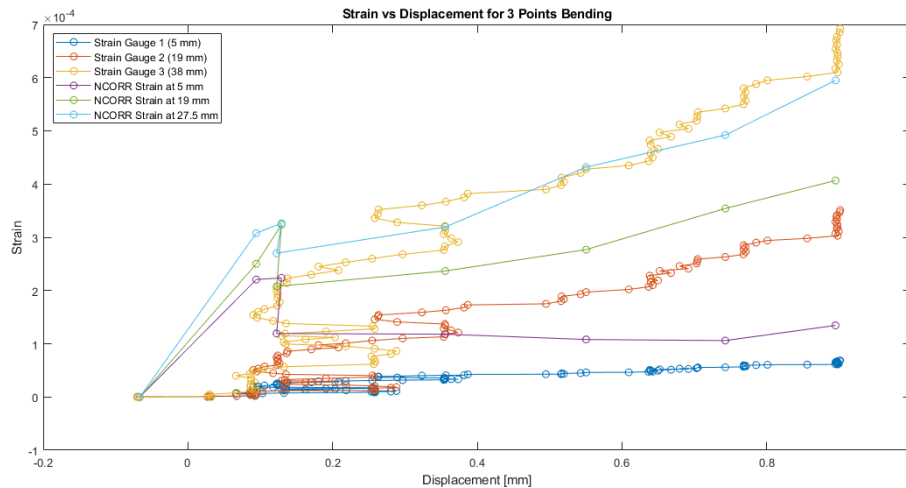
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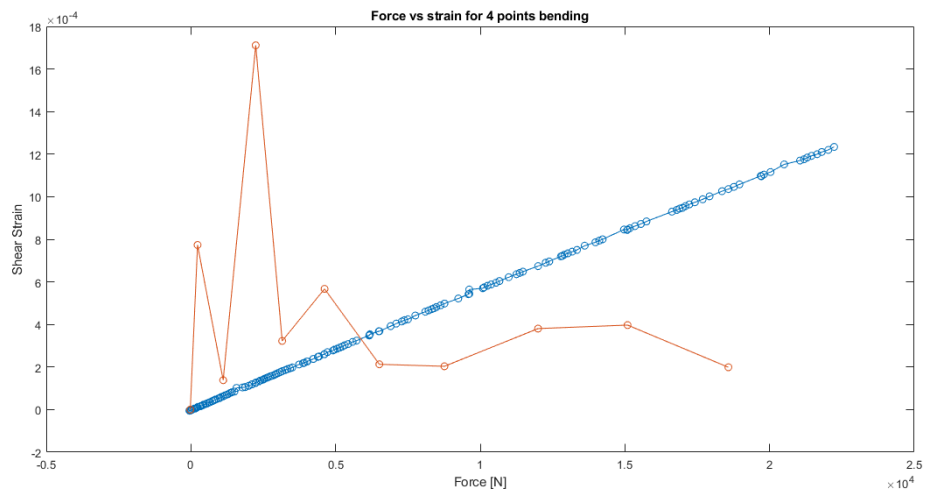
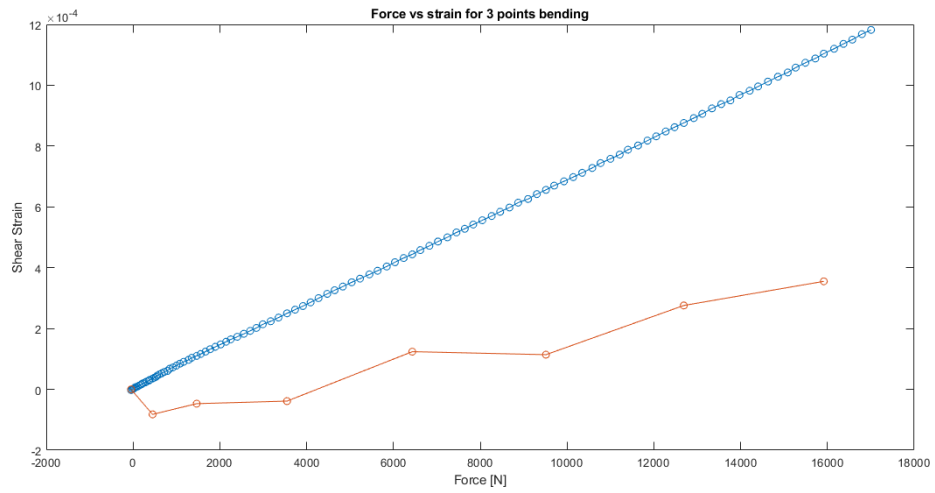
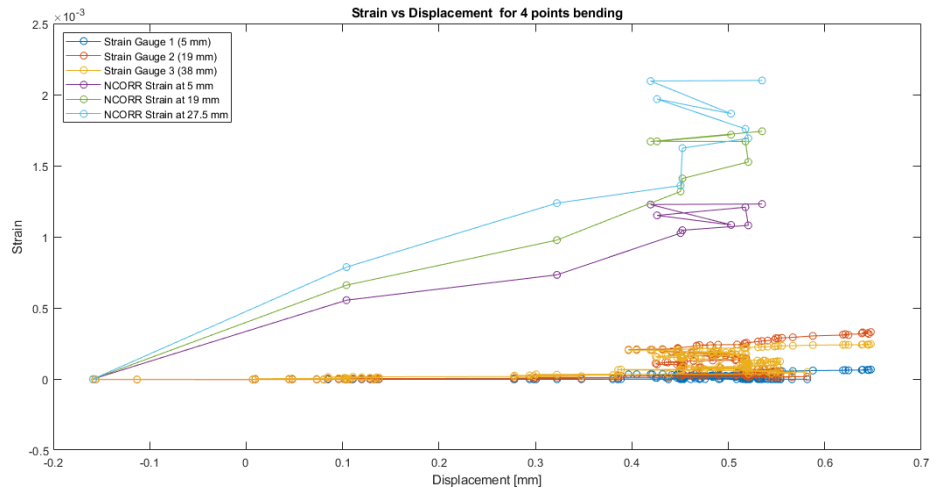
strain1 =
    [5.536983000000000e-05,0.0002590000000000000,0.0005350000000000000];
picstrain1 = -1*[-0.000001797306, -0.00010595612, -1.79e-04,
    -2.47e-04, -0.000354158, -0.000420132, -0.000492094];
strain2 =
    [1.270446000000000e-06,6.994194000000000e-05,0.0001330000000000000]; %
    do it later
picstrain2 = -1*[-0.001098992, -0.00120797, -1.22e-03, -0.00162484,
    -0.00167052, -0.00177278, -0.001759];
picdis = [0, 5, 10, 15, 19, 23, 27.5];
distance = [5, 19, 38];

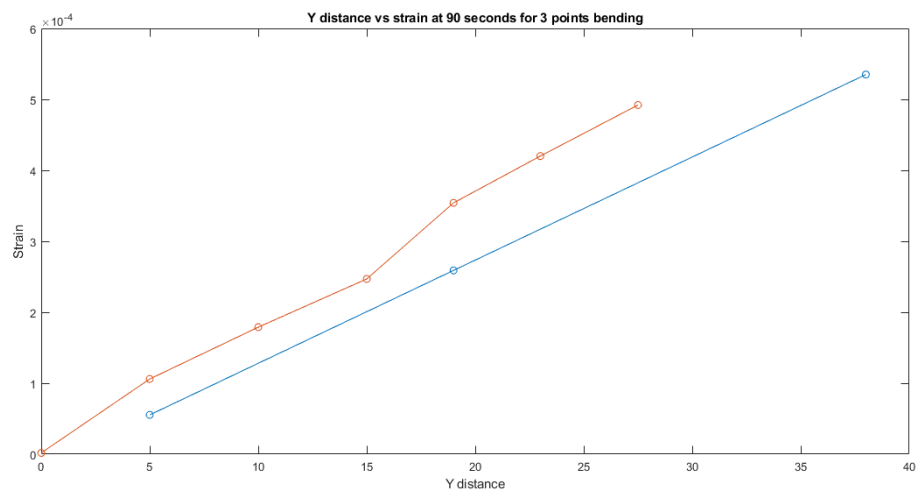
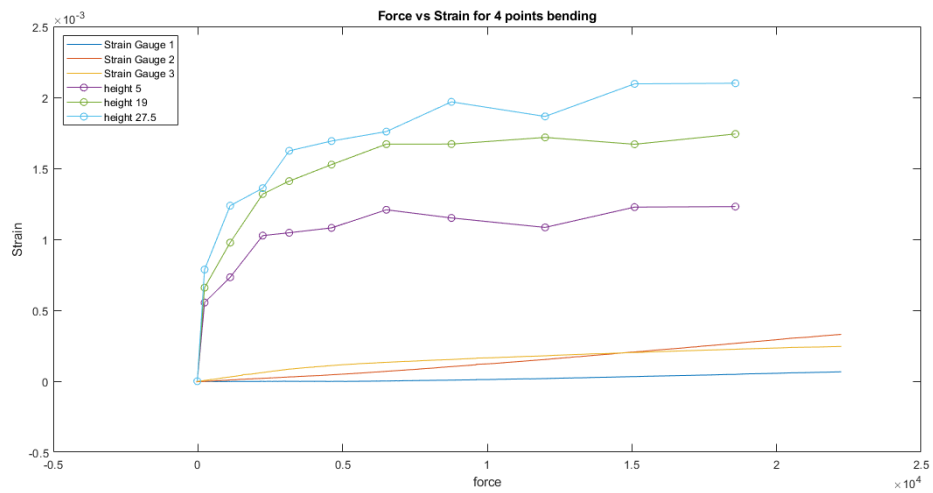
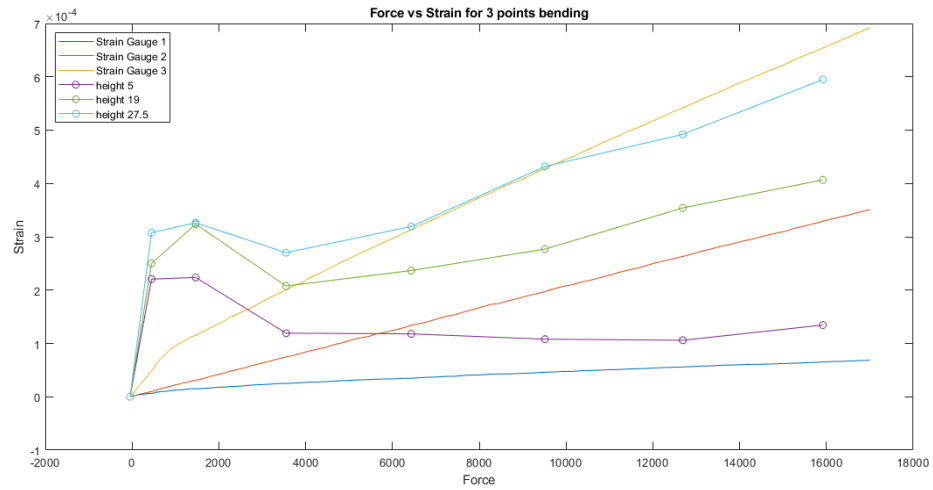
figure(7);
plot(distance,strain1,'-o')
hold on
plot(picdis, picstrain1, '-o')
xlabel('Y distance')
ylabel('Strain')
title('Y distance vs strain at 90 seconds for 3 points bending')
hold off

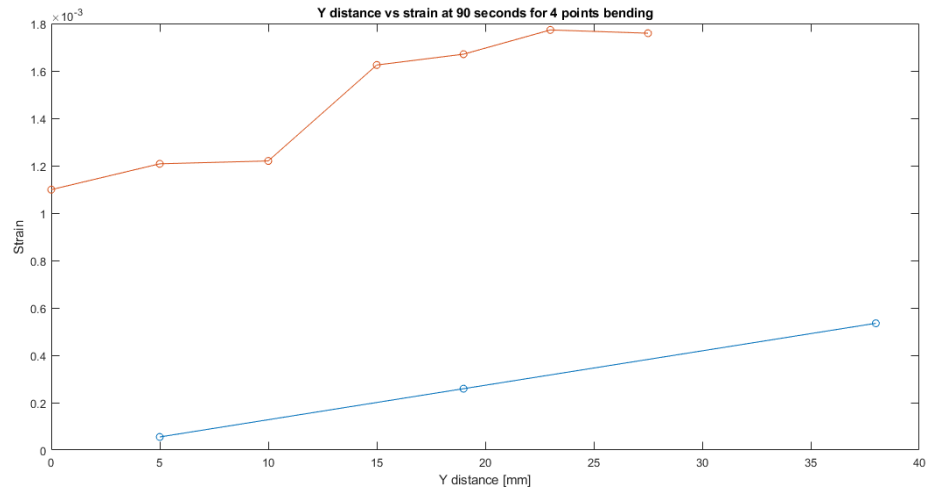
figure(8);
plot(distance,strain1,'-o')
hold on
plot(picdis, picstrain2, '-o')
xlabel('Y distance [mm]')
ylabel('Strain')
title('Y distance vs strain at 90 seconds for 4 points bending')
hold off

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