Table of Contents

```
clc; clear;

q =3.64*10^1 * 1/144 % psi


q =

    0.2528
```

x vs y Plot

```
xVals = [0 0.1 0.2 0.4 0.6 0.8 1.2 1.6 2 2.4 3.2 4 4.8 5.6 6.4 7.2 7.6 8 ...
    7.6 7.2 6.4 5.6 3.2 2.4 2 1.6 1.2 0.8 0.6 0.4 0.2 0.1 0];

yVals = [0, -0.15152, -0.2092, -0.2844, -0.336, -0.37464, -0.4276, ...
    -0.45896, -0.47528, -0.48016, -0.46424, -0.42352, -0.36504, -0.29312, ...
    -0.20984, -0.11584, -0.06456, 0.008, 0.06456, 0.11584, 0.20984,...
    0.29312, 0.46424, 0.48016, 0.47528, 0.45896, 0.4276, 0.37464, 0.336, ...
    0.2844, 0.2092, 0.15152 0];

figure(4)
plot(xVals, yVals, 'color', 'black', 'linewidth', 1.5);
xlabel('x - Values')
ylabel('y - Values')
xlim([min(xVals)-1 max(xVals)+1])
ylim([min(yVals)-1 max(yVals)+0.5])
grid on

title('Airfoil x, y')
```

Airfoil x, y
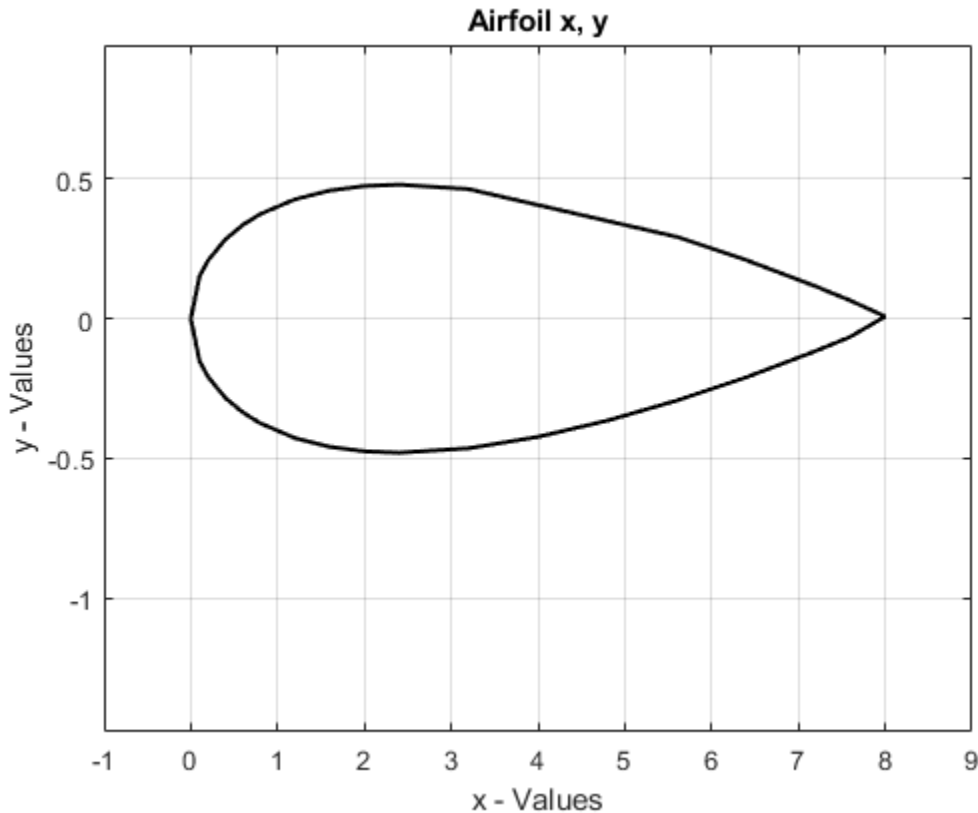
Cp vs. X/C at AOA

pressureDatapsi = [1.85E-01 -2.43E-01 -2.75E-01 -2.65E-01 -2.48E-01 -1.95E-02 -2.37E-01 -2.11E-01 -1.98E-01 4.94E-02 -1.67E-01 -1.44E-01 7.91E-03 -1.10E-01 -8.58E-02 -5.98E-02 -4.63E-02 -1.57E-02 -6.46E-02 -7.60E-02 -8.59E-02 -9.98E-02 -1.30E-01 -1.35E-01 -1.41E-01 -1.41E-01 -1.44E-01 -1.34E-01 -1.19E-01 -1.01E-01 -6.83E-02 -2.06E-02]; pressureDatapsf = pressureDatapsi * 144;

dynamicPressure = 1.07E+01;

coefficientsPressure = pressureDatapsf / dynamicPressure;

xOverc = [0, 0.0125, 0.025, 0.05, 0.075, 0.1, 0.15, 0.2, 0.25, 0.3,... 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 0.95, 1.0000, .9500, 0.9000,... 0.8000, 0.7000, 0.4000, 0.3000, 0.2500, 0.2000, 0.1500, 0.1000,... 0.0750, 0.0500, 0.0250, 0.0125];

for i = 1:16 coefficientsPressure(i) = coefficientsPressure(i) * -1; end

coefficientsPressure01 = coefficientsPressure;

for i = 3:29 if abs(coefficientsPressure(i) - coefficientsPressure(i-1)) > 1 coefficientsPressure(i) = (coefficientsPressure(i-1) + coefficientsPressure(i+1))/2; end end coefficientsPressure(1) = 0; coefficientsPressure(32) = 0; coefficientsPressure01(1) = 0; coefficientsPressure01(32) = 0; coefficientsPressure(2) = coefficientsPressure(2) - 1; coefficientsPressure(3) = coefficientsPressure(3) - 1; coefficientsPressure01(2) = coefficientsPressure01(2) - 1; coefficientsPressure01(3) = coefficientsPressure01(3) - 1;

plot(xOverc, coefficientsPressure01, 'color', 'black', 'linewidth', 1) hold on plot(xOverc, coefficientsPressure, 'color', 'red', 'linewidth', 1.5) xlabel('X/c', 'fontsize', 12) ylabel('Coefficients of Pressure (Cp)', 'fontsize', 12) legend('Uninterpolated Data', 'Interpolated Data') grid on hold off

AOA -4

```
xOverc = [0, 0.0125, 0.025, 0.05, 0.075, 0.1, 0.15, 0.2, 0.25, 0.3,...
          0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 0.95, 1.0000, .9500, 0.9000,...
          0.8000, 0.7000, 0.4000, 0.3000, 0.2500, 0.2000, 0.1500, 0.1000,...
          0.0750, 0.0500, 0.0250, 0.0125];

yOverc = [0    -0.01894    -0.02615    -0.03555    -0.042    -0.04683
-0.05345...
    -0.05737    -0.05941    -0.06002    -0.05803    -0.05294    -0.04563
-0.03664...
    -0.02623    -0.01448    -0.00807    0.0126    0.00807    0.01448
0.02623    0.03664    0.05803...
    0.06002    0.05941    0.05737    0.05345    0.04683    0.042
0.03555    0.02615    0.01894];

pneg4 = [-9.74E-02    -6.62E-01    -5.72E-01    -4.66E-01    -4.06E-01...
    -3.55E-02    -3.37E-01    -2.85E-01    -2.64E-01    4.75E-02
-2.07E-01...
    -1.72E-01    4.88E-03    -1.23E-01    -9.47E-02    -6.72E-02
-5.67E-02...
    -4.57E-02    -4.95E-02    -5.73E-02    -6.12E-02    -7.12E-02
-7.73E-02...
    -7.03E-02    -6.73E-02    -5.65E-02    -4.48E-02    -1.65E-02
8.93E-03...
    4.47E-02    1.01E-01    1.56E-01];

pneg4unfixed = pneg4;

for i = 3:29
    if (pneg4(i) - pneg4(i-1)) > 0.1
        pneg4(i) = (pneg4(i-1) + pneg4(i+1))/2;
    end
end

pneg4(1) = -0.8;
pneg4unfixed(1) = -0.8;

lower = pneg4(1:17);
upper = pneg4(17:32);

figure(1)
plot(xOverc, pneg4unfixed, 'linewidth', 1)
hold on
plot(xOverc, pneg4, 'linewidth', 1)
scatter(xOverc(1:17), lower, 'filled')
scatter(xOverc(17:32), upper, 'filled')
xlabel('X/c (in)')
ylabel('Pressure (psi)')
```

```matlab
title('-4 Deg. AOA Pressure vs. X/c')
grid on
set(gca, 'YDir','reverse')
legend({'Uninterpolated', 'Interpolated', '$P_{lower}$', '$P_{upper}$'},
'Interpreter', 'latex');
hold off

% Cp vs. x/c @ AoA = -4
q =3.64*10^1 * 1/144 % psi

Cp_lower = lower/q ;
Cp_upper = upper/q ;

figure(2)
plot(xOverc(1:17), Cp_lower, 'linewidth', 1)
hold on
plot(xOverc(17:32), Cp_upper, 'linewidth', 1)
set(gca, 'YDir','reverse')
legend({'$C_{p,lower}$', '$C_{p,upper}$'}, 'Interpreter', 'latex');
xlabel('X/c (in)')
ylabel('C_p')
title('-4 Deg. AOA C_p vs. X/c')
grid on
hold off

figure(3)
plot(Cp_lower, yOverc(1:17), 'linewidth', 1)
hold on
plot(Cp_upper, yOverc(17:32), 'linewidth', 1)
legend('$C_{p,lower}$', '$C_{p,upper}$', 'Interpreter', 'latex');
xlabel('C_p (in)')
ylabel('y/c')
title('-4 Deg. AOA C_p vs. y/c')
grid on
hold off

% Finding Area under Cp curve
% For Cp_lower
N_l = trapz(xOverc(1:17), Cp_lower);
% For Cp_upper
N_u= trapz(xOverc(17:32), Cp_upper);

% Solve for C_N
c_bar = 8/4; %c/4
C_N_neg4 = (N_u + N_l)

% Solve for C_c
% N_l_cc = trapz(Cp_lower,yOverc(1:17))
% N_u_cc = trapz(Cp_upper,yOverc(17:32))
N_l_cc = trapz(yOverc(1:17),Cp_lower)
N_u_cc = trapz(yOverc(17:32),Cp_upper)
C_N_neg4_cc = N_l_cc+N_u_cc
```

```
q =

    0.2528


C_N_neg4 =

    -0.6008


N_l_cc =

    0.1031


N_u_cc =

    -0.0218


C_N_neg4_cc =

    0.0813
```
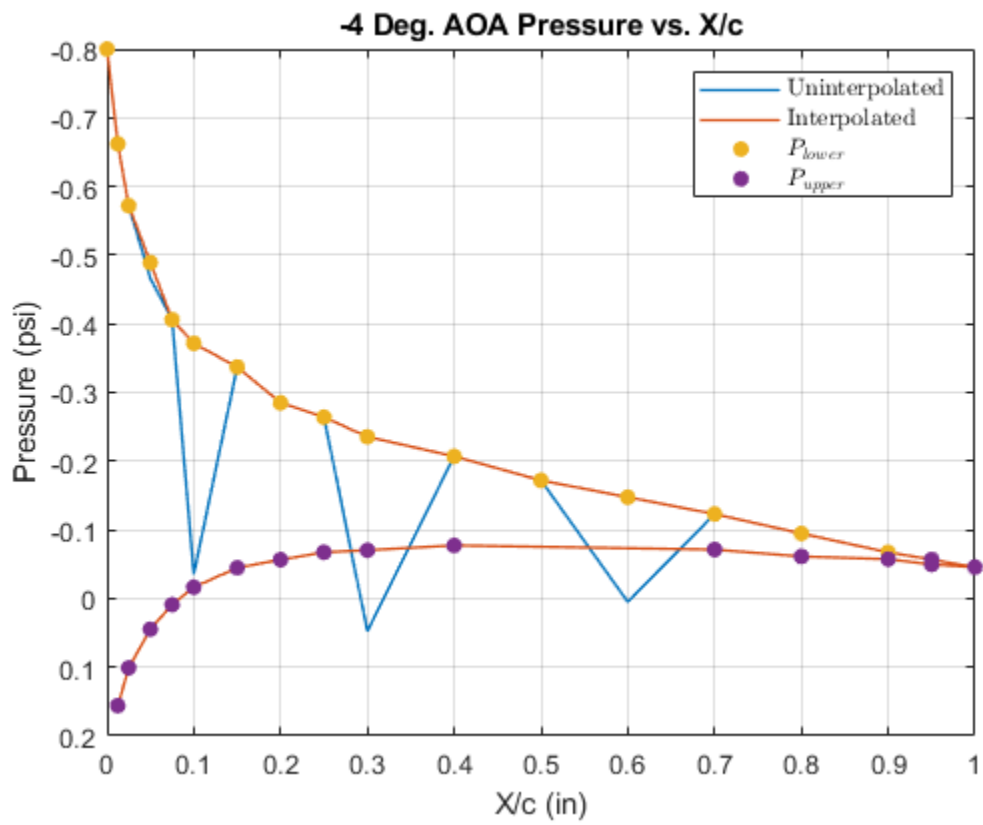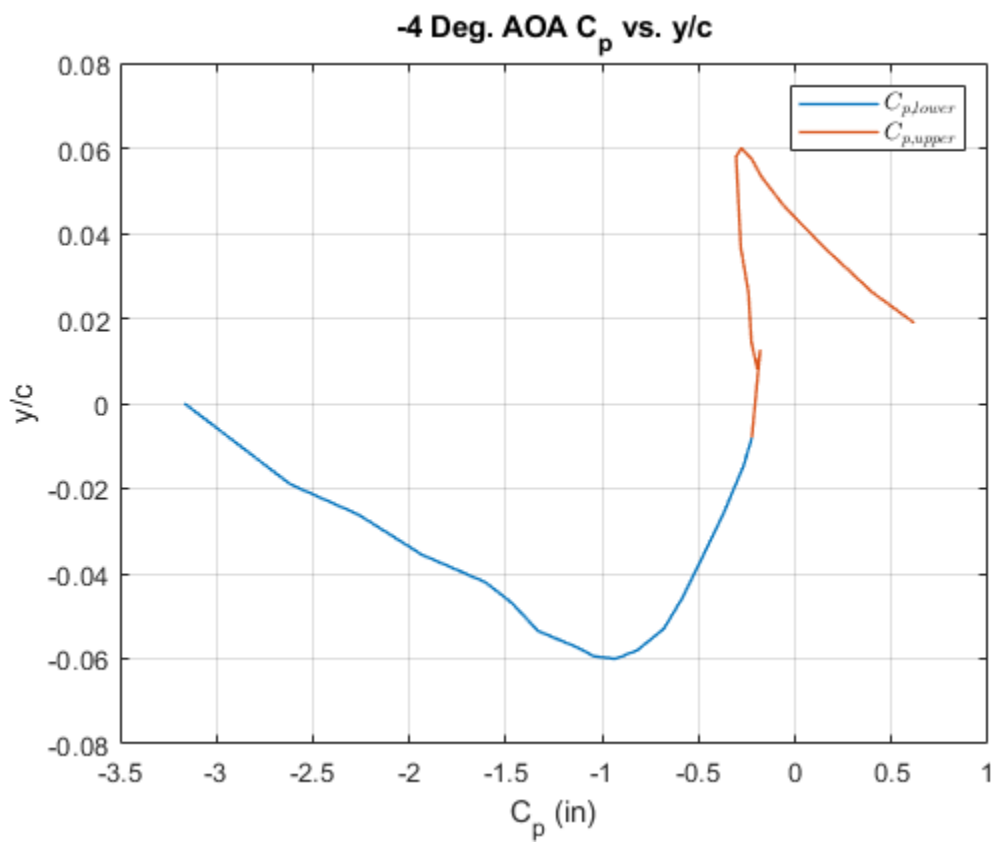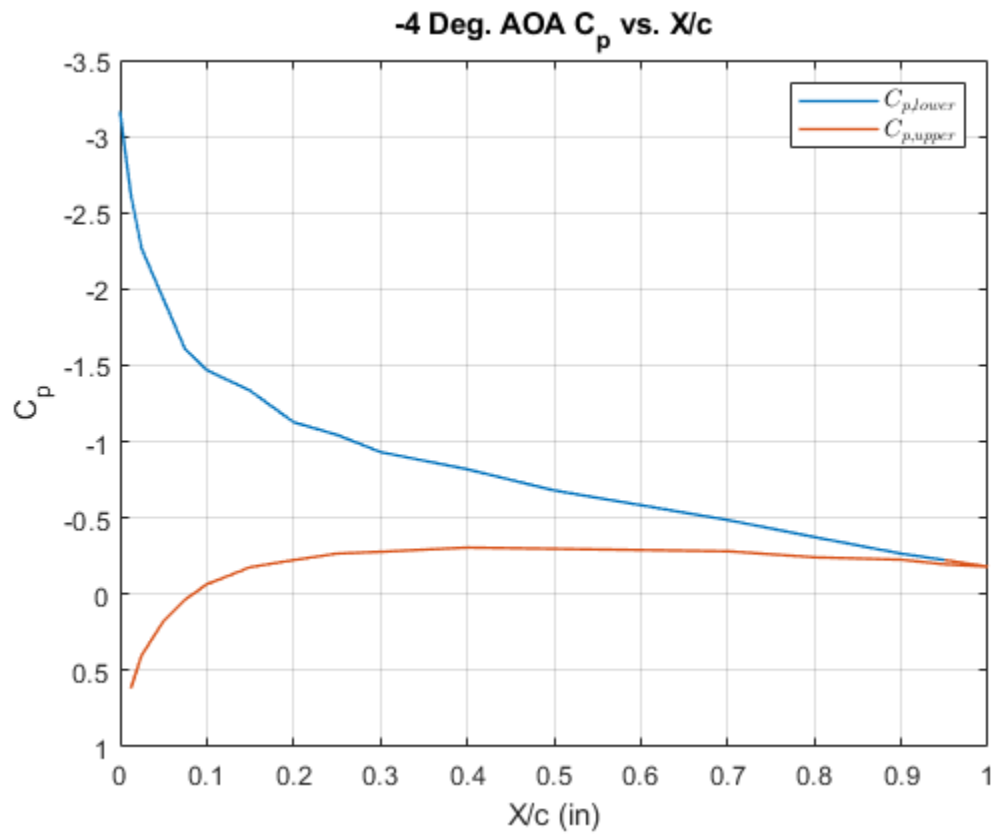

-4 Deg. AOA Pressure vs. X/c

-4 Deg. AOA C_p vs. X/c

-4 Deg. AOA C_p vs. y/c

AOA 0

```matlab
p0 = [1.85E-01    -2.43E-01    -2.75E-01    -2.65E-01    -2.48E-01...
    -1.95E-02    -2.37E-01    -2.11E-01    -1.98E-01    4.94E-02
-1.67E-01...
    -1.44E-01    7.91E-03    -1.10E-01    -8.58E-02    -5.98E-02
-4.63E-02...
    -1.57E-02    -6.46E-02    -7.60E-02    -8.59E-02    -9.98E-02
-1.30E-01...
    -1.35E-01    -1.41E-01    -1.41E-01    -1.44E-01    -1.34E-01
-1.19E-01...
    -1.01E-01    -6.83E-02    -2.06E-02];

p0unfixed = p0;

for i = 3:29
    if (p0(i) - p0(i-1)) > 0.1
        p0(i) = (p0(i-1) + p0(i+1))/2;
    end
end

p0(1) = -0.2;
p0unfixed(1) = -0.2;

lower = p0(1:17);
upper = p0(17:32);

figure(1)
plot(xOverc, p0unfixed, 'linewidth', 1)
hold on
plot(xOverc, p0, 'linewidth', 1)
scatter(xOverc(1:17), lower, 'filled')
scatter(xOverc(17:32), upper, 'filled')
set(gca, 'YDir','reverse')
legend({'Uninterpolated', 'Interpolated', '$P_{lower}$', '$P_{upper}$'},
'Interpreter', 'latex');
xlabel('X/c (in)')
ylabel('Pressure (psi)')
title('0 Deg. AOA Pressure vs. X/c')
grid on
hold off

% Cp vs. x/c @ AoA = 0
q =3.64*10^1 * 1/144 % psi

Cp_lower = lower/q ;
Cp_upper = upper/q ;

figure(2)
plot(xOverc(1:17), Cp_lower, 'linewidth', 1)
hold on
plot(xOverc(17:32), Cp_upper, 'linewidth', 1)
legend('$C_{p,lower}$', '$C_{p,upper}$', 'Interpreter', 'latex');
```

```matlab
xlabel('X/c (in)')
ylabel('C_p')
title('0 Deg. AOA C_p vs. X/c')
grid on
hold off

% Finding Area under Cp curve
% For Cp_lower;
N_l = trapz(xOverc(1:17), Cp_lower);

% For Cp_upper;
N_u= trapz(xOverc(17:32), Cp_upper);

% Solve for C_N
c_bar = 8/4 ;%c/4
C_N_0 = (N_u + N_l)

% Solve for C_c
% N_l_cc = trapz(Cp_lower,yOverc(1:17))
% N_u_cc = trapz(Cp_upper,yOverc(17:32))
N_l_cc = trapz(yOverc(1:17),Cp_lower)
N_u_cc =trapz(yOverc(17:32),Cp_upper)
C_N_0_cc = N_l_cc+N_u_cc
```

q =

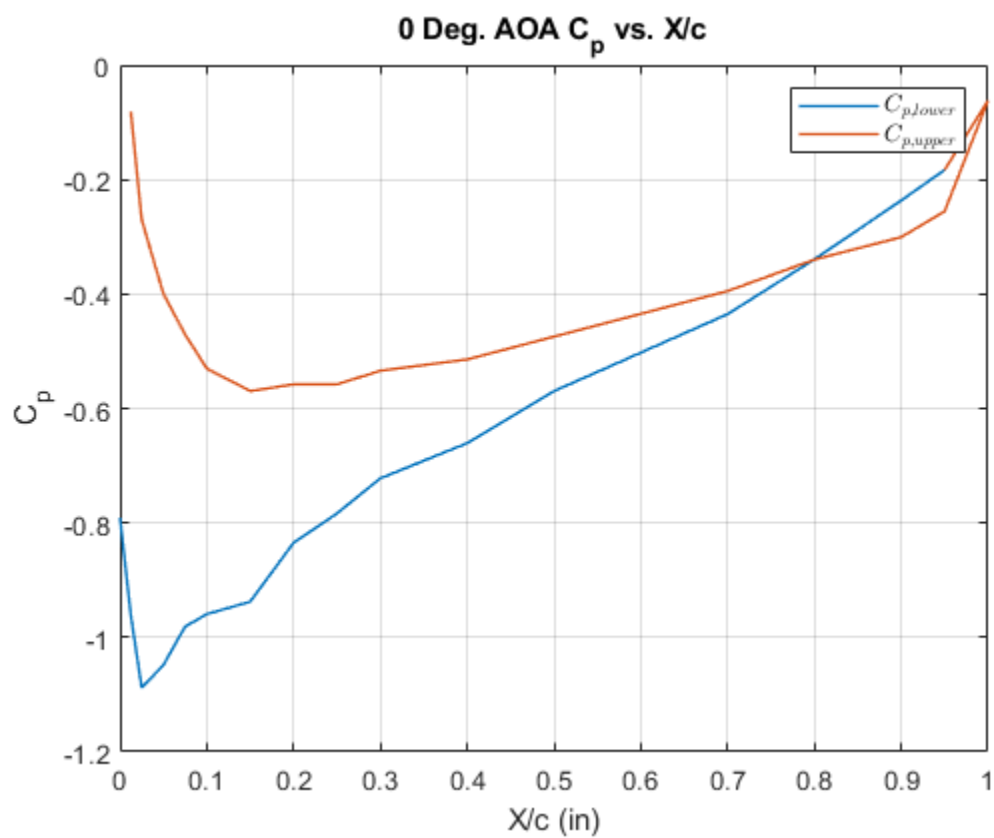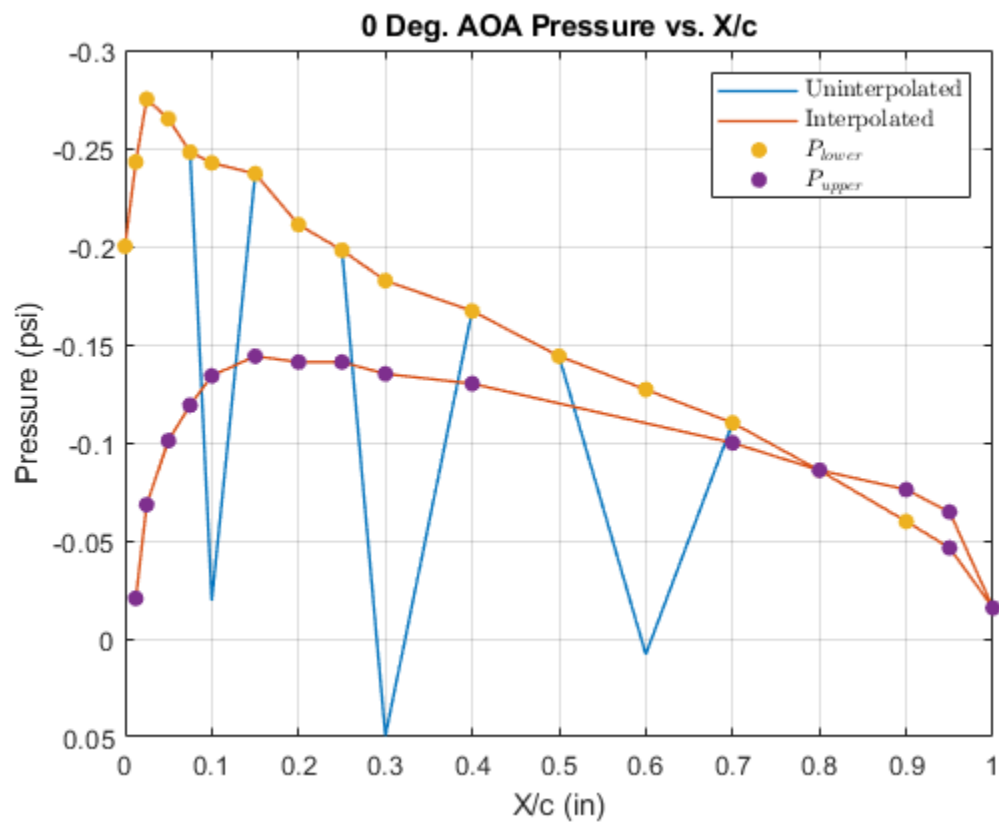   *0.2528*

C_N_0 =

  -0.1610

N_l_cc =

   0.0357

N_u_cc =

  -0.0050

C_N_0_cc =

   0.0307

0 Deg. AOA Pressure vs. X/c

0 Deg. AOA C_p vs. X/c

AOA 4

```matlab
p4 = [1.79E-01    4.49E-02    -3.63E-02    -8.49E-02    -1.03E-01...
    -8.39E-03    -1.39E-01    -1.30E-01    -1.31E-01    5.08E-02
-1.23E-01...
    -1.09E-01    1.09E-02    -9.04E-02    -7.35E-02    -5.64E-02
-4.79E-02...
    -1.85E-02    -6.20E-02    -7.90E-02    -9.48E-02    -1.23E-01
-1.72E-01...
    -1.91E-01    -2.07E-01    -2.18E-01    -2.39E-01    -2.56E-01
-2.60E-01...
    -2.76E-01    -2.97E-01    -3.11E-01];

p4unfixed = p4;

for i = 3:29
    if (p4(i) - p4(i-1)) > 0.05
        p4(i) = (p4(i-1) + p4(i+1))/2;
    end
end

lower = p4(1:17);
upper = p4(17:32);

figure(1)
plot(xOverc, p4unfixed, 'linewidth', 1)
hold on
plot(xOverc, p4, 'linewidth', 1)
scatter(xOverc(1:17), lower, 'filled')
scatter(xOverc(17:32), upper, 'filled')
set(gca, 'YDir','reverse')
legend({'Uninterpolated', 'Interpolated', '$P_{lower}$', '$P_{upper}$'},
'Interpreter', 'latex');
xlabel('X/c (in)')
ylabel('Pressure (psi)')
title('4 Deg. AOA Pressure vs. X/c')
grid on
hold off

% Cp vs. x/c @ AoA = 4
q =3.64*10^1 * 1/144 % psi

Cp_lower = lower/q ;
Cp_upper = upper/q ;

figure(2)
plot(xOverc(1:17), Cp_lower, 'linewidth', 1)
hold on
plot(xOverc(17:32), Cp_upper, 'linewidth', 1)
legend('$C_{p,lower}$', '$C_{p,upper}$', 'Interpreter', 'latex');
xlabel('X/c (in)')
ylabel('C_p')
title('4 Deg. AOA C_p vs. X/c')
```

```matlab
set(gca, 'YDir','reverse')
grid on
hold off

figure(3)
plot(Cp_lower, yOverc(1:17), 'linewidth', 1)
hold on
plot(Cp_upper, yOverc(17:32), 'linewidth', 1)
legend('$C_{p,lower}$', '$C_{p,upper}$', 'Interpreter', 'latex');
xlabel('C_p (in)')
ylabel('y/c')
title('4 Deg. AOA C_p vs. y/c')
grid on
hold off

% Finding Area under Cp curve
% For Cp_lower
N_l = trapz(xOverc(1:17), Cp_lower);

% For Cp_upper
N_u= trapz(xOverc(17:32), Cp_upper);

% Solve for C_N
c_bar = 8/4; %c/4
C_N_4 = (N_u + N_l);

% Solve for C_c
% N_l_cc = trapz(Cp_lower,yOverc(1:17))
% N_u_cc = trapz(Cp_upper,yOverc(17:32))
N_l_cc = trapz(yOverc(1:17),Cp_lower)
N_u_cc = trapz(yOverc(17:32),Cp_upper)
C_N_4_cc = N_l_cc+N_u_cc


q =

    0.2528


N_l_cc =

    -0.0123


N_u_cc =

    0.0171


C_N_4_cc =

    0.0048
```
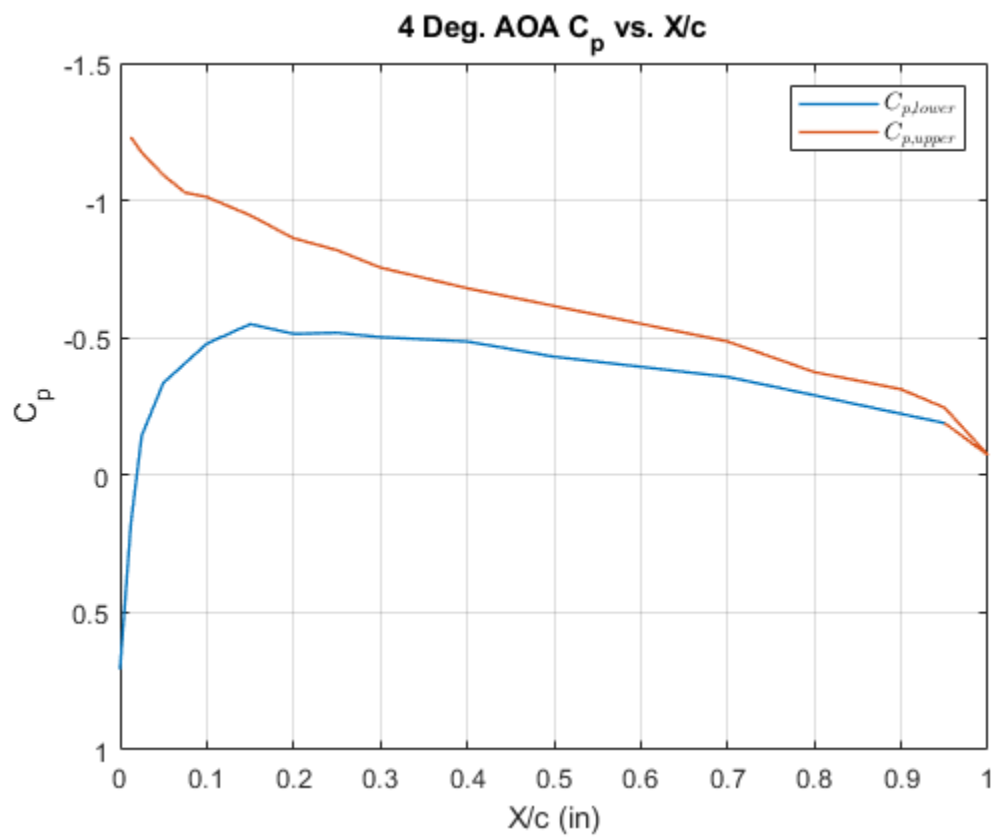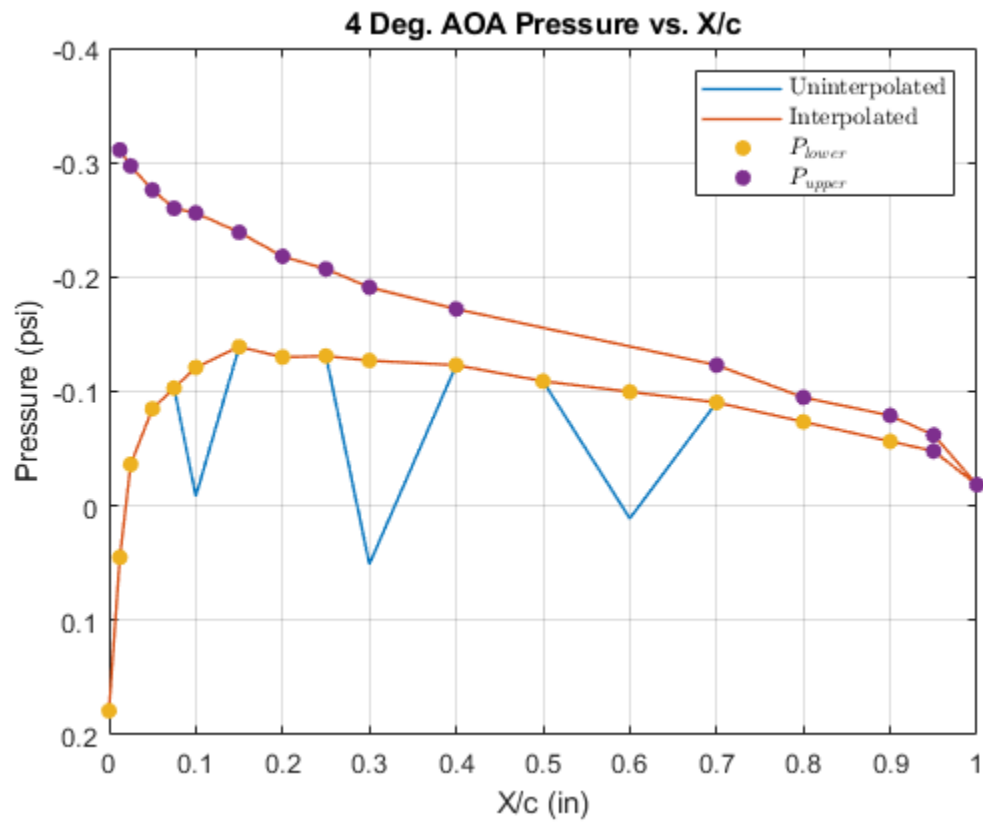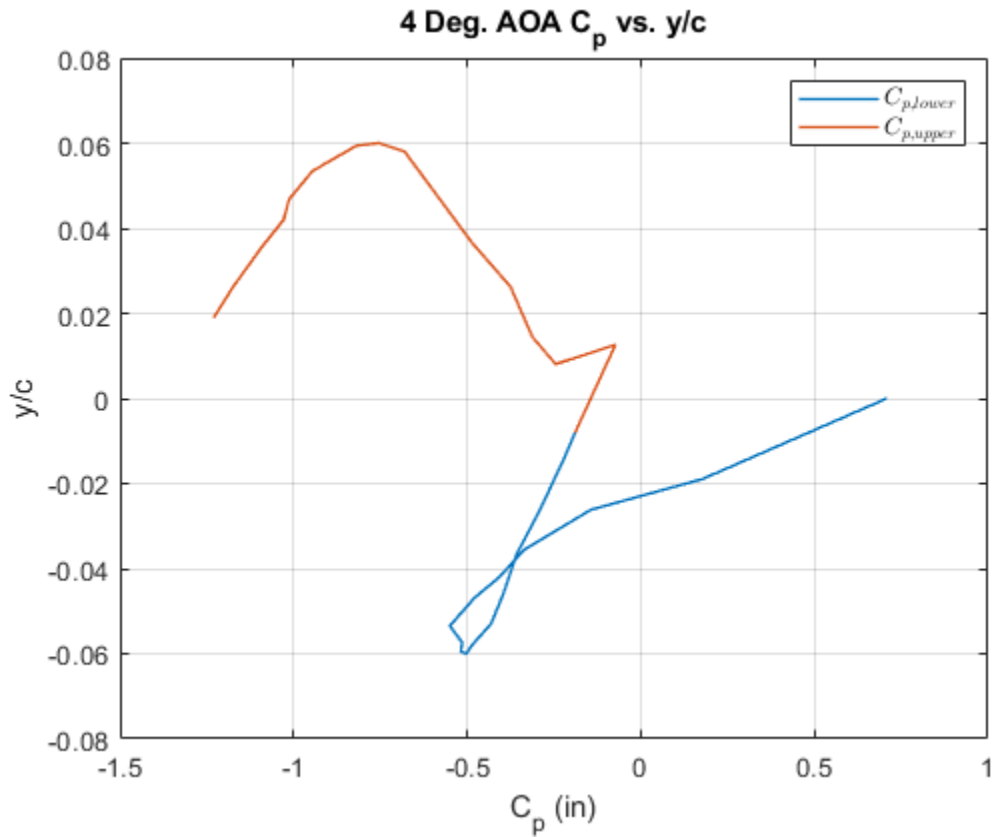
4 Deg. AOA Pressure vs. X/c

4 Deg. AOA C_p vs. X/c

4 Deg. AOA C_p vs. y/c

AOA 8

```
p8 = [-1.44E-01    1.87E-01    1.29E-01    6.32E-02    2.63E-02...
    -4.10E-05    -3.83E-02    -4.52E-02    -5.61E-02    5.27E-02
-7.06E-02...
    -6.71E-02    1.33E-02    -6.19E-02    -5.18E-02    -4.32E-02
-3.90E-02...
    -3.25E-02    -5.84E-02    -7.71E-02    -1.00E-01    -1.31E-01
-2.13E-01...
    -2.48E-01    -2.75E-01    -3.00E-01    -3.43E-01    -3.80E-01
-4.23E-01...
    -4.84E-01    -5.77E-01    -7.04E-01];

p8unfixed = p8;

for i = 3:29
    if (p8(i) - p8(i-1)) > 0.05
        p8(i) = (p8(i-1) + p8(i+1))/2;
    end
end

p8(1) = 0.3;
p8unfixed(1) = 0.3;

lower = p8(1:17);
```

```matlab
upper = p8(17:32);

figure(1)
plot(xOverc, p8unfixed, 'linewidth', 1)
hold on
plot(xOverc, p8, 'linewidth', 1)
scatter(xOverc(1:17), lower, 'filled')
scatter(xOverc(17:32), upper, 'filled')
set(gca, 'YDir','reverse')
legend({'Uninterpolated', 'Interpolated', '$P_{lower}$', '$P_{upper}$'}, ...
'Interpreter', 'latex');
xlabel('X/c (in)')
ylabel('Pressure (psi)')
title('8 Deg. AOA Pressure vs. X/c')
grid on
hold off

figure(2)
% Cp vs. x/c @ AoA = 8
q =3.64*10^1 * 1/144 % psi

Cp_lower = lower/q ;
Cp_upper = upper/q ;

figure(2)
plot(xOverc(1:17), Cp_lower, 'linewidth', 1)
hold on
plot(xOverc(17:32), Cp_upper, 'linewidth', 1)
legend('$C_{p,lower}$', '$C_{p,upper}$', 'Interpreter', 'latex');
xlabel('X/c (in)')
ylabel('C_p')
title('8 Deg. AOA C_p vs. X/c')
set(gca, 'YDir','reverse')
grid on
hold off

figure(3)
plot(Cp_lower, yOverc(1:17), 'linewidth', 1)
hold on
plot(Cp_upper, yOverc(17:32), 'linewidth', 1)
legend('$C_{p,lower}$', '$C_{p,upper}$', 'Interpreter', 'latex');
xlabel('C_p (in)')
ylabel('y/c')
title('8 Deg. AOA C_p vs. y/c')
grid on
hold off

% For Cp_lower
N_l = trapz(xOverc(1:17), Cp_lower);

% For Cp_upper
N_u= trapz(xOverc(17:32), Cp_upper);

% Solve for C_N
```

```matlab
c_bar = 8/4 ;%c/4
C_N_8 = (N_u + N_l)

% Solve for C_c
% N_l_cc = trapz(Cp_lower,yOverc(1:17))
% N_u_cc = trapz(Cp_upper,yOverc(17:32))
N_l_cc = trapz(yOverc(1:17),Cp_lower)
N_u_cc = trapz(yOverc(17:32),Cp_upper)
C_N_8_cc = N_l_cc+N_u_cc
```

q =

   0.2528

C_N_8 =

   0.6508

N_l_cc =

  -0.0377

N_u_cc =

   0.0456

C_N_8_cc =

   0.0079

8 Deg. AOA Pressure vs. X/c

8 Deg. AOA C_p vs. X/c

8 Deg. AOA C_p vs. y/c
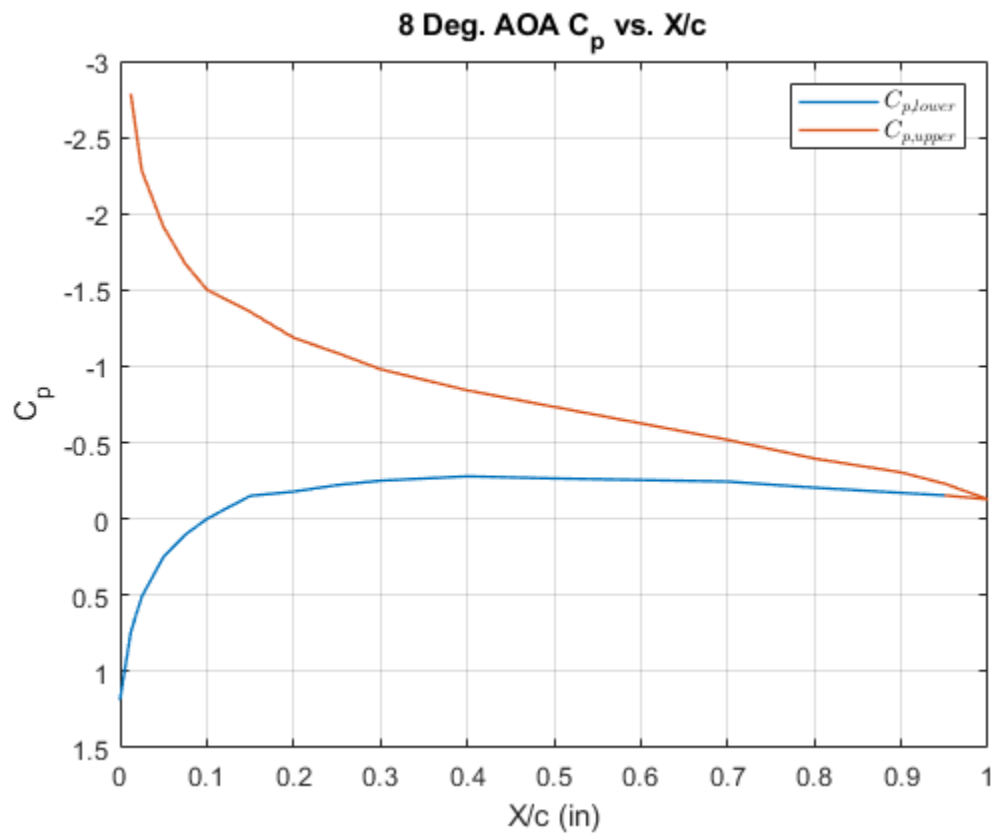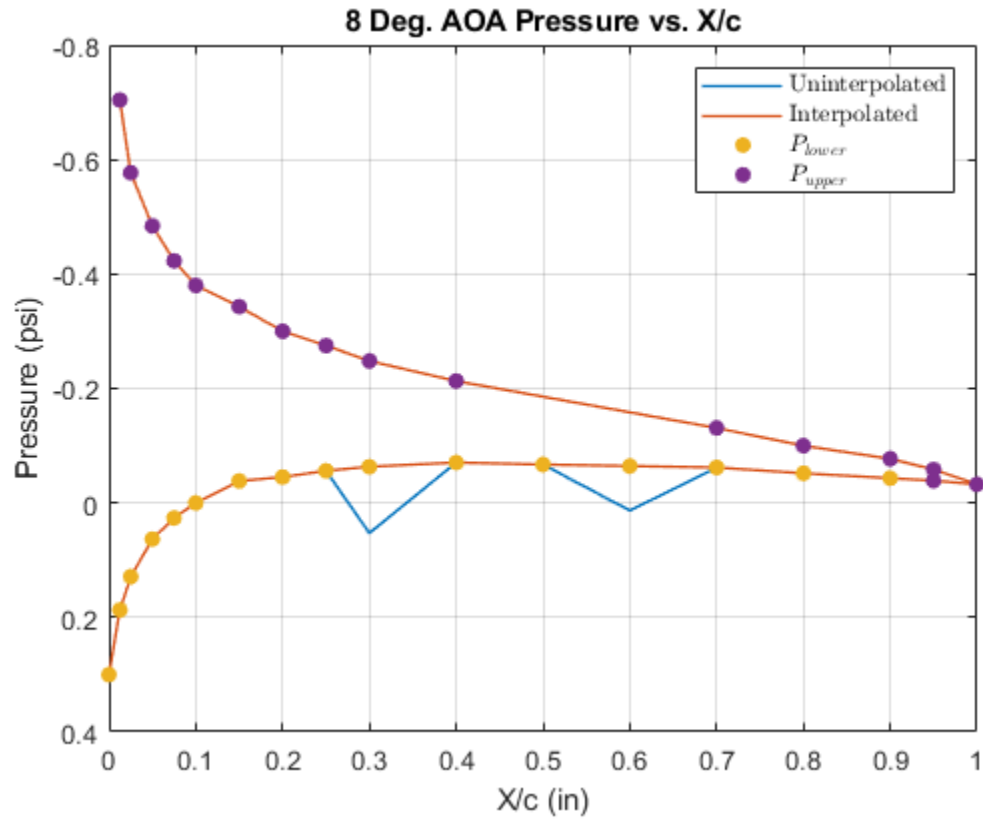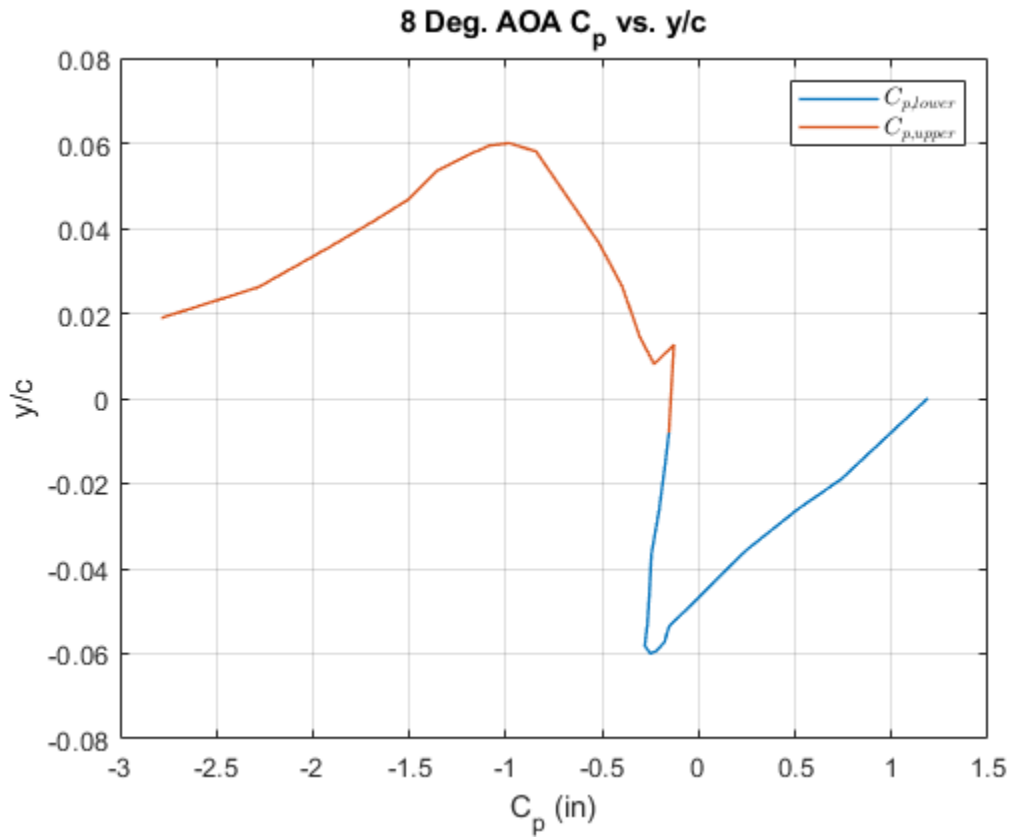
AOA 10

```
p10 = [-3.82E-01    1.94E-01    1.67E-01    1.08E-01    6.90E-02...
    2.72E-03    -9.81E-04    -1.29E-02    -2.77E-02    5.32E-02
-5.00E-02...
    -5.11E-02    1.49E-02    -5.33E-02    -4.69E-02    -4.14E-02
-4.03E-02...
    -3.61E-02    -5.33E-02    -7.07E-02    -9.60E-02    -1.29E-01
-2.23E-01...
    -2.65E-01    -2.97E-01    -3.29E-01    -3.82E-01    -4.45E-01
-4.80E-01...
    -5.14E-01    -7.32E-01    -8.89E-01];

p10unfixed = p10;

for i = 3:29
    if (p10(i) - p10(i-1)) > 0.05
        p10(i) = (p10(i-1) + p10(i+1))/2;
    end
end

p10(1) = 0.3;
p10unfixed(1) = 0.3;

lower = p10(1:17);
```

```matlab
upper = p10(17:32);

figure(1)
plot(xOverc, p10unfixed, 'linewidth', 1)
hold on
plot(xOverc, p10, 'linewidth', 1)
scatter(xOverc(1:17), lower, 'filled')
scatter(xOverc(17:32), upper, 'filled')
set(gca, 'YDir','reverse')
legend({'Uninterpolated', 'Interpolated', '$P_{lower}$', '$P_{upper}$'},
'Interpreter', 'latex');
xlabel('X/c (in)')
ylabel('Pressure (psi)')
title('10 Deg. AOA Pressure vs. X/c')
grid on
hold off

% Cp vs. x/c @ AoA = 10
q =3.64*10^1 * 1/144 % psi

Cp_lower = lower/q ;
Cp_upper = upper/q ;

figure(2)
plot(xOverc(1:17), Cp_lower, 'linewidth', 1)
hold on
plot(xOverc(17:32), Cp_upper, 'linewidth', 1)
legend('$C_{p,lower}$', '$C_{p,upper}$', 'Interpreter', 'latex');
xlabel('X/c (in)')
ylabel('C_p')
title('10 Deg. AOA C_p vs. X/c')
set(gca, 'YDir','reverse')
grid on
hold off


figure(3)
plot(Cp_lower, yOverc(1:17), 'linewidth', 1)
hold on
plot(Cp_upper, yOverc(17:32), 'linewidth', 1)
legend('$C_{p,lower}$', '$C_{p,upper}$', 'Interpreter', 'latex');
xlabel('C_p (in)')
ylabel('y/c')
title('10 Deg. AOA C_p vs. y/c')
grid on
hold off
% For Cp_lower
N_l = trapz(xOverc(1:17), Cp_lower);

% For Cp_upper
N_u= trapz(xOverc(17:32), Cp_upper);

% Solve for C_N
c_bar = 8/4; %c/4
C_N_10 = (N_u + N_l)
```

```
% Solve for C_c
% N_l_cc = trapz(Cp_lower,yOverc(1:17))
% N_u_cc = trapz(Cp_upper,yOverc(17:32))
N_l_cc = trapz(yOverc(1:17),Cp_lower)
N_u_cc = trapz(yOverc(17:32),Cp_upper)
C_N_10_cc = N_l_cc+N_u_cc
```
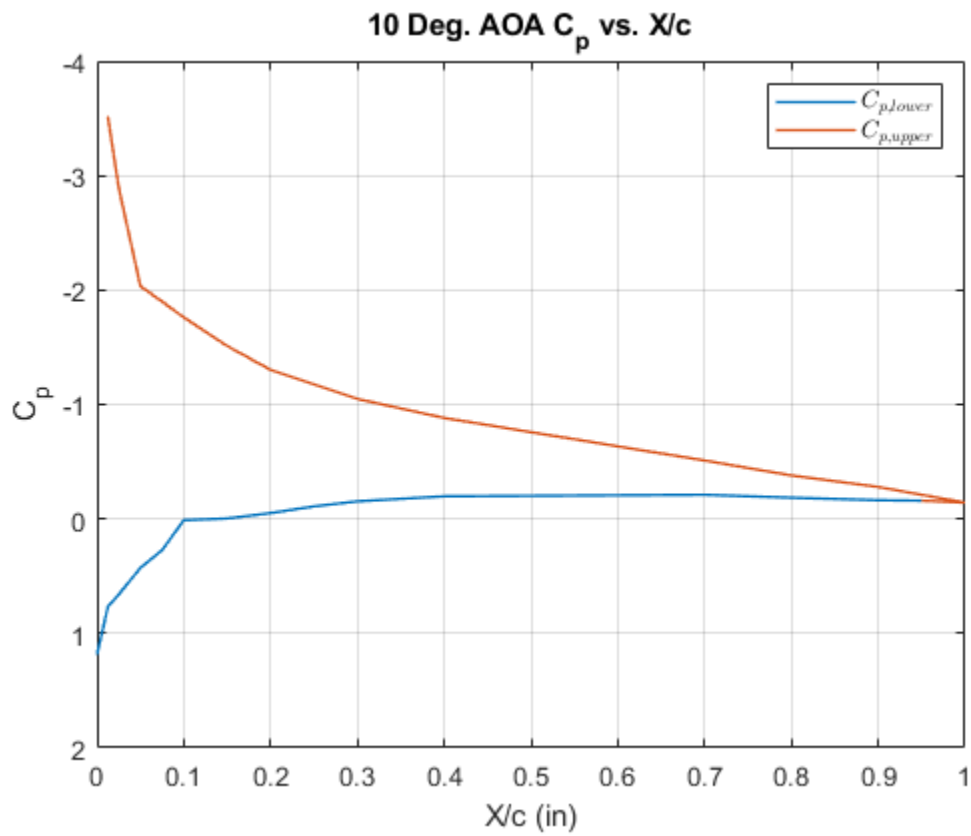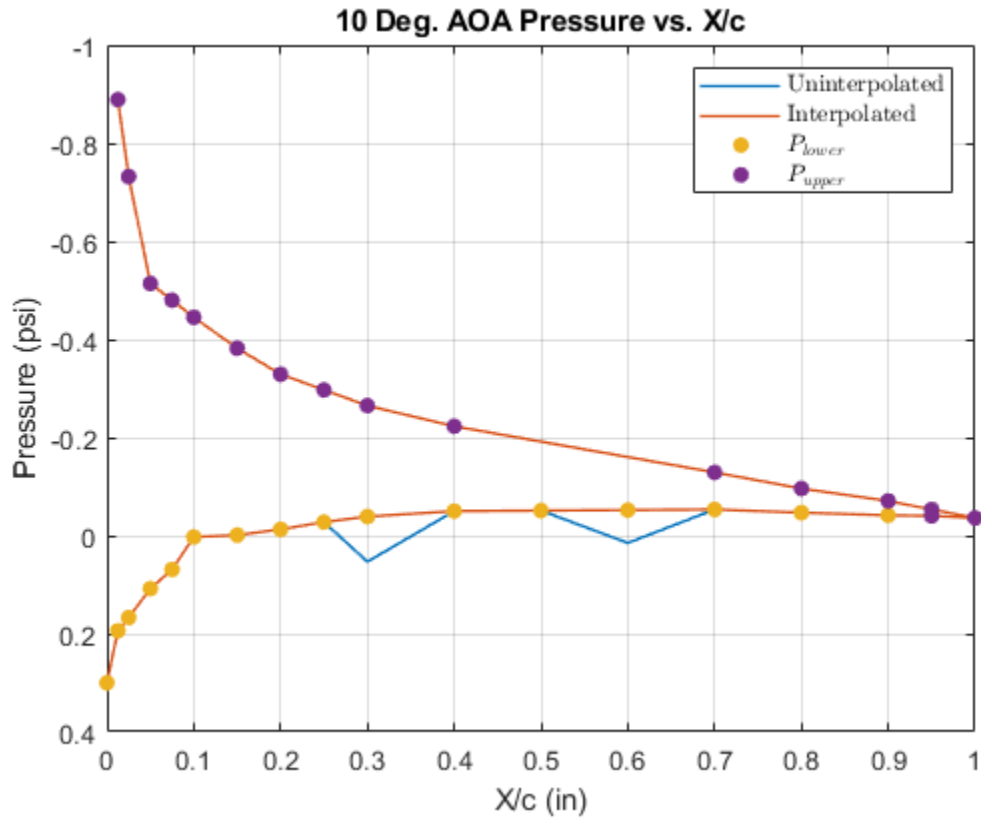
q =

    0.2528

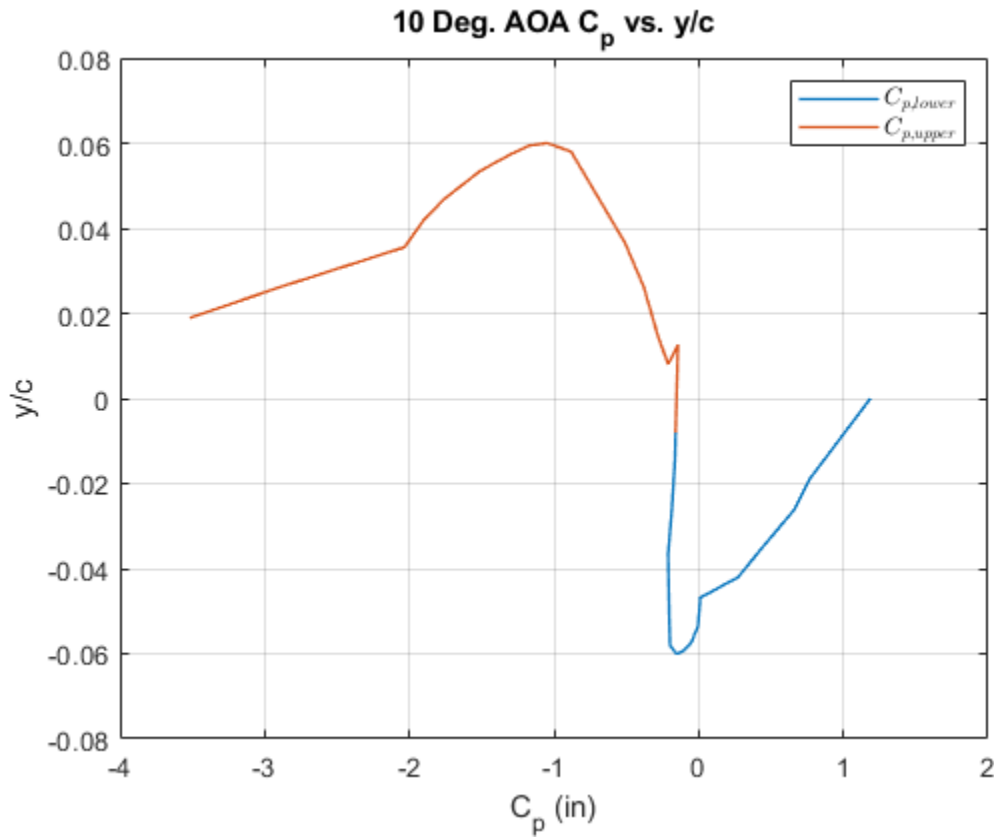*C_N_10 =*

    0.7736

N_l_cc =

   -0.0413

N_u_cc =

    0.0581

C_N_10_cc =

    0.0169

10 Deg. AOA Pressure vs. X/c

10 Deg. AOA C_p vs. X/c

AOA 12

```
p12 = [-6.75E-01    1.80E-01    1.86E-01    1.43E-01    1.05E-01...
    5.51E-03    3.12E-02    1.48E-02    -2.75E-03    5.39E-02    -3.20E-02...
    -3.81E-02    1.56E-02    -4.73E-02    -4.47E-02    -4.41E-02
-4.92E-02...
    -4.68E-02    -5.51E-02    -6.82E-02    -9.29E-02    -1.26E-01
-2.34E-01...
    -2.83E-01    -3.20E-01    -3.59E-01    -4.22E-01    -5.03E-01
-5.55E-01...
    -6.27E-01    -9.31E-01, -1.2];

p12unfixed = p12;

for i = 3:29
    if (p12(i) - p12(i-1)) > 0.03
        p12(i) = (p12(i-1) + p12(i+1))/2;
    end
end

p12(1) = 0.45; p12unfixed(1) = 0.3;
p12(6) = 0.1; p12(2) = 0.3;

lower = p12(1:17);
upper = p12(17:32);
```

```matlab
figure(1)
plot(xOverc, p12unfixed, 'linewidth', 1)
hold on
plot(xOverc, p12, 'linewidth', 1)
scatter(xOverc(1:17), lower, 'filled')
scatter(xOverc(17:32), upper, 'filled')
set(gca, 'YDir','reverse')
legend({'Uninterpolated', 'Interpolated', '$P_{lower}$', '$P_{upper}$'}, ...
'Interpreter', 'latex');
xlabel('X/c (in)')
ylabel('Pressure (psi)')
title('12 Deg. AOA Pressure vs. X/c')
grid on
hold off

% Cp vs. x/c @ AoA = 12
q =3.64*10^1 * 1/144 % psi

Cp_lower = lower/q ;
Cp_upper = upper/q ;

figure(2)
plot(xOverc(1:17), Cp_lower, 'linewidth', 1)
hold on
plot(xOverc(17:32), Cp_upper, 'linewidth', 1)
legend( 'Cp_lower', 'Cp_upper')
xlabel('X/c (in)')
ylabel('C_p')
title('12 Deg. AOA C_p vs. X/c')
set(gca, 'YDir','reverse')
grid on
hold off

figure(3)
plot(Cp_lower, yOverc(1:17), 'linewidth', 1)
hold on
plot(Cp_upper, yOverc(17:32), 'linewidth', 1)
legend('$C_{p,lower}$', '$C_{p,upper}$', 'Interpreter', 'latex');
xlabel('C_p (in)')
ylabel('y/c')
title('12 Deg. AOA C_p vs. y/c')
grid on
hold off


% For Cp_lower
N_l = trapz(xOverc(1:17), Cp_lower);

% For Cp_upper
N_u= trapz(xOverc(17:32), Cp_upper);

% Solve for C_N
c_bar = 8/4; %c/4
```

```
C_N_12 = (N_u + N_l)

% Solve for C_c
% N_l_cc = trapz(Cp_lower,yOverc(1:17))
% N_u_cc = trapz(Cp_upper,yOverc(17:32))
N_l_cc = trapz(yOverc(1:17),Cp_lower)
N_u_cc = trapz(yOverc(17:32),Cp_upper)
C_N_12_cc = N_l_cc+N_u_cc
```

q =

   0.2528

C_N_12 =

   0.9234

N_l_cc =

  -0.0572

N_u_cc =

   0.0761

C_N_12_cc =

   0.0189

12 Deg. AOA Pressure vs. X/c

12 Deg. AOA C_p vs. X/c
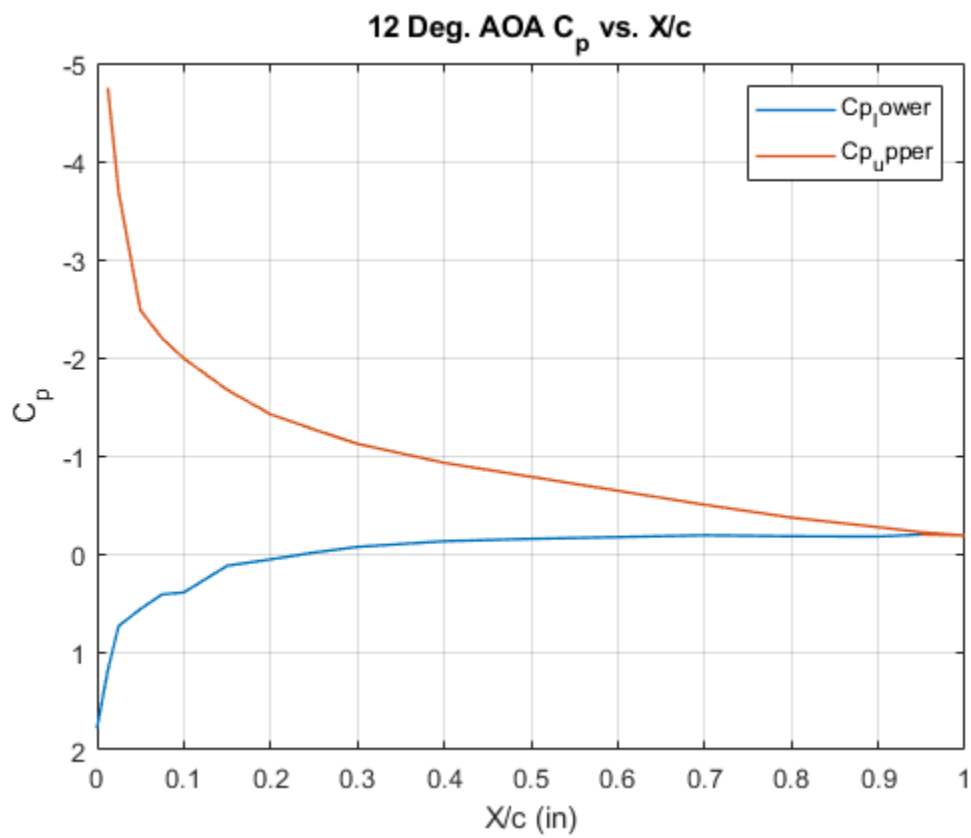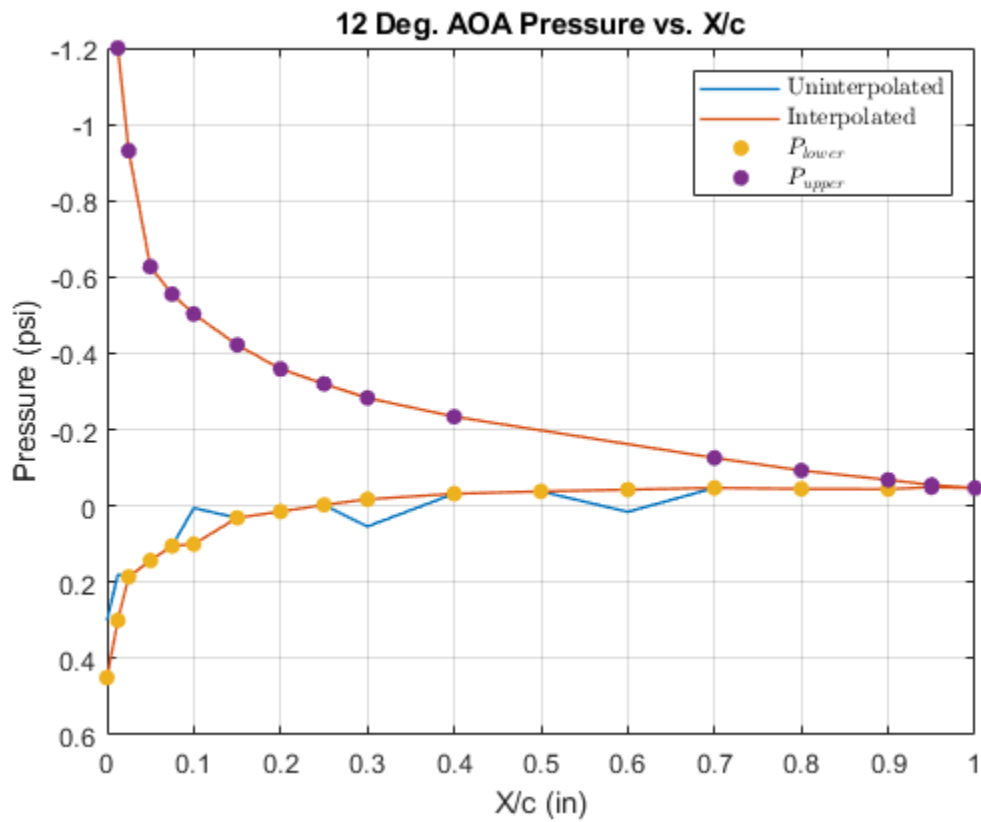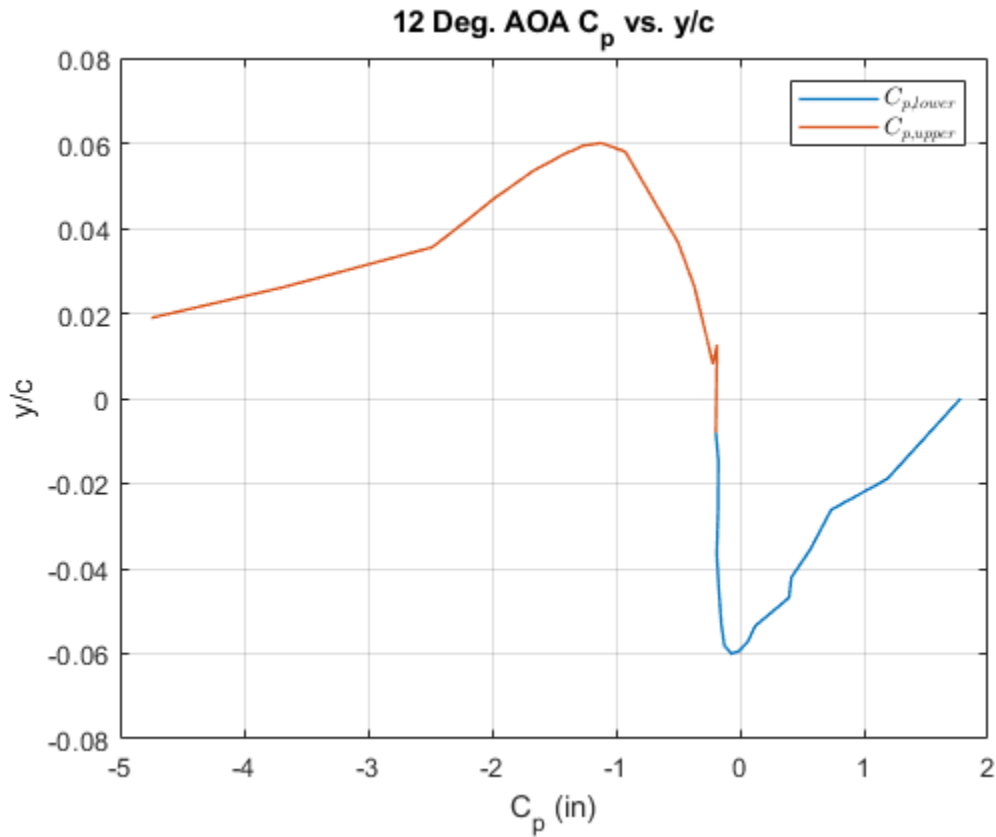
AOA 13

```
p13 = [-8.24E-01    1.63E-01    1.89E-01    1.54E-01    1.18E-01...
    5.86E-03    4.43E-02    2.69E-02    8.41E-03    5.41E-02    -2.42E-02...
    -3.23E-02    1.68E-02    -4.45E-02    -4.34E-02    -4.66E-02
-5.47E-02...
    -5.47E-02    -5.99E-02    -6.98E-02    -9.09E-02    -1.22E-01
-2.36E-01...
    -2.89E-01    -3.27E-01    -3.70E-01    -4.38E-01    -5.26E-01
-5.85E-01...
    -6.70E-01    -1.05E+00    -1.14E+00];

p13unfixed = p13;

for i = 3:29
    if (p13(i) - p13(i-1)) > 0.03
        p13(i) = (p13(i-1) + p13(i+1))/2;
    end
end

p13(1) = 0.35; p13(2) = 0.25; p13(6) = 0.07;
p13unfixed(1) = 0.35;

lower = p13(1:17);
upper = p13(17:32);
```

```matlab
figure(1)
plot(xOverc, p13unfixed, 'linewidth', 1)
hold on
plot(xOverc, p13, 'linewidth', 1)
scatter(xOverc(1:17), lower, 'filled')
scatter(xOverc(17:32), upper, 'filled')
set(gca, 'YDir','reverse')
legend({'Uninterpolated', 'Interpolated', '$P_{lower}$', '$P_{upper}$'}, ...
'Interpreter', 'latex');
xlabel('X/c (in)')
ylabel('Pressure (psi)')
title('13 Deg. AOA Pressure vs. X/c')
grid on
hold off

% Cp vs. x/c @ AoA = 13
q =3.64*10^1 * 1/144 % psi

Cp_lower = lower/q ;
Cp_upper = upper/q ;

figure(2)
plot(xOverc(1:17), Cp_lower, 'linewidth', 1)
hold on
plot(xOverc(17:32), Cp_upper, 'linewidth', 1)
legend('$C_{p,lower}$', '$C_{p,upper}$', 'Interpreter', 'latex');
xlabel('X/c (in)')
ylabel('C_p')
set(gca, 'YDir','reverse')
title('13 Deg. AOA C_p vs. X/c')
grid on
hold off

figure(3)
plot(Cp_lower, yOverc(1:17), 'linewidth', 1)
hold on
plot(Cp_upper, yOverc(17:32), 'linewidth', 1)
legend('$C_{p,lower}$', '$C_{p,upper}$', 'Interpreter', 'latex');
xlabel('C_p (in)')
ylabel('y/c')
title('13 Deg. AOA C_p vs. y/c')
grid on
hold off

% For Cp_lower
N_l = trapz(xOverc(1:17), Cp_lower);

% For Cp_upper
N_u= trapz(xOverc(17:32), Cp_upper);

% Solve for C_N
c_bar = 8/4; %c/4
C_N_13 = (N_u + N_l)
```

```
% Solve for C_c
% N_l_cc = rapz(Cp_lower,yOverc(1:17))
% N_u_cc = trapz(Cp_upper,yOverc(17:32))
N_l_cc = trapz(yOverc(1:17),Cp_lower)
N_u_cc = trapz(yOverc(17:32),Cp_upper)
C_N_13_cc = N_l_cc+N_u_cc
```
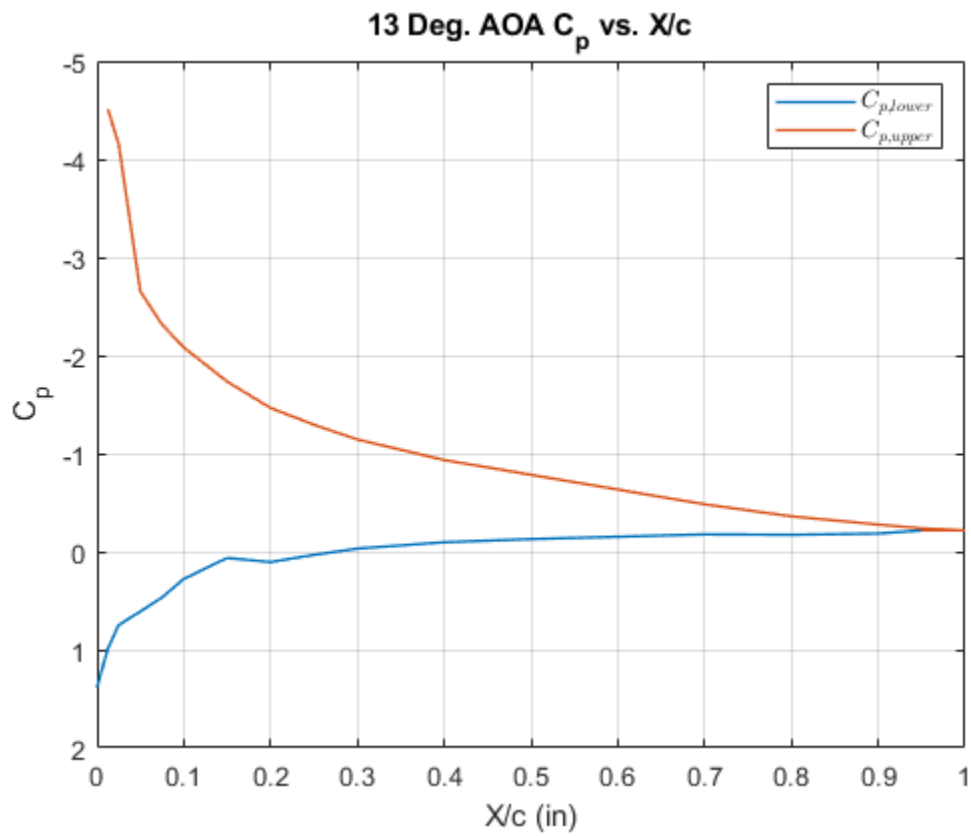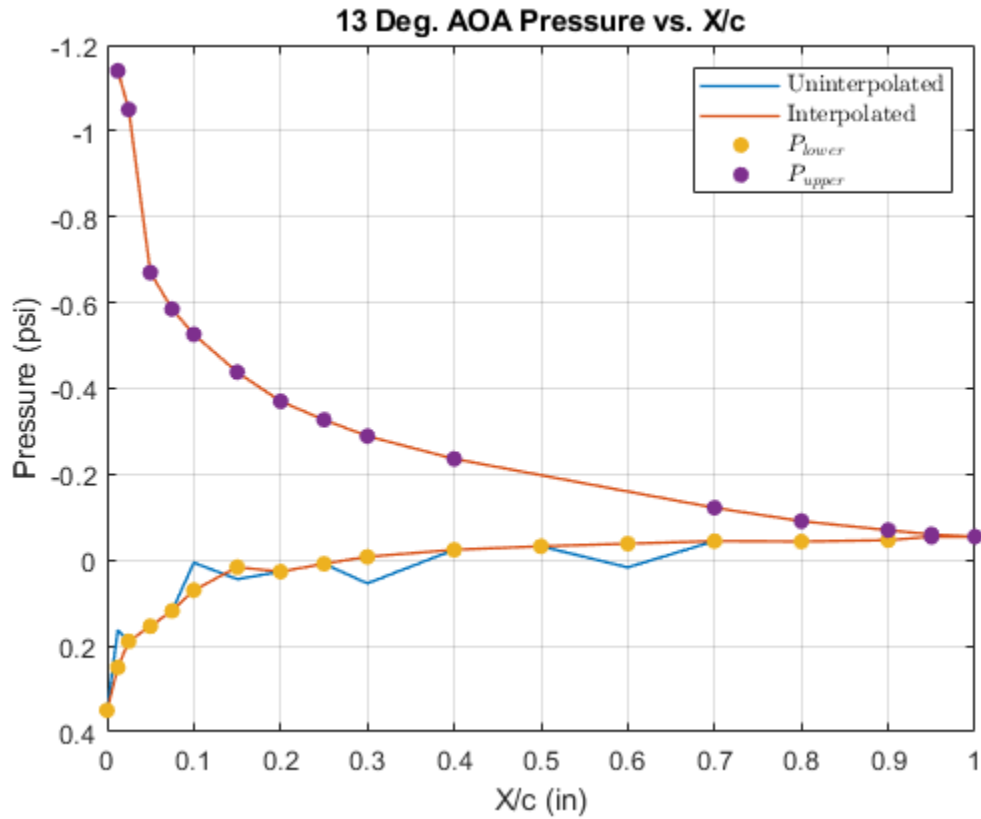
q =

    0.2528

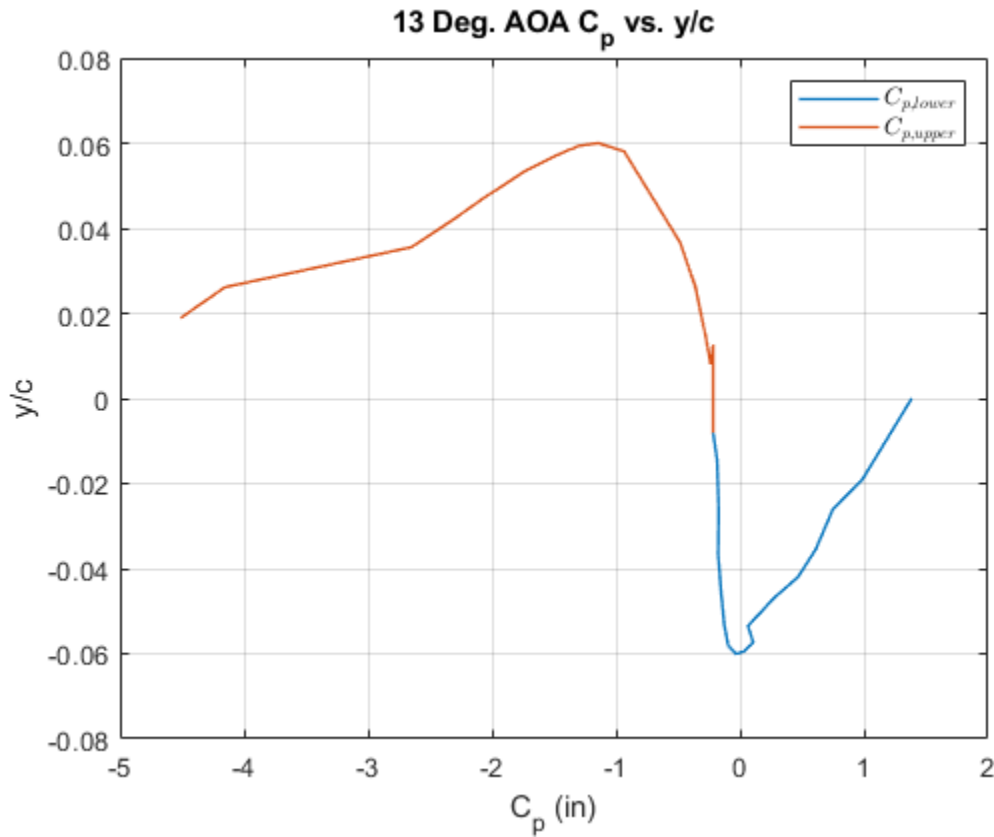*C_N_13 =*

    0.9535

N_l_cc =

   -0.0504

N_u_cc =

    0.0819

C_N_13_cc =

    0.0315

13 Deg. AOA Pressure vs. X/c

13 Deg. AOA C$_p$ vs. X/c

13 Deg. AOA C_p vs. y/c

AOA 14

```
p14 = [-9.63E-01    1.42E-01    1.86E-01    1.62E-01    1.29E-01...
    7.08E-03    5.64E-02    3.76E-02    1.85E-02    5.32E-02    -1.69E-02...
    -2.66E-02    1.70E-02    -4.13E-02    -4.32E-02    -4.84E-02
-6.02E-02...
    -6.34E-02    -6.66E-02    -7.31E-02    -8.79E-02    -1.15E-01
-2.31E-01...
    -2.86E-01    -3.28E-01    -3.72E-01    -4.44E-01    -5.39E-01
-6.04E-01...
    -7.04E-01    -1.14E+00    -1.20E+00];

p14unfixed = p14;

for i = 3:29
    if (p14(i) - p14(i-1)) > 0.03
        p14(i) = (p14(i-1) + p14(i+1))/2;
    end
end

p14(1) = 0.45; p14(2) = 0.4; p14(3) = 0.3; p14(6) = 0.08;
p14unfixed(1) = 0.45; p14unfixed(2) = 0.4;

lower = p14(1:17);
upper = p14(17:32);
```

```matlab
figure(1)
plot(xOverc, p14unfixed, 'linewidth', 1)
hold on
plot(xOverc, p14, 'linewidth', 1)
scatter(xOverc(1:17), lower, 'filled')
scatter(xOverc(17:32), upper, 'filled')
set(gca, 'YDir','reverse')
legend({'Uninterpolated', 'Interpolated', '$P_{lower}$', '$P_{upper}$'},
'Interpreter', 'latex');
xlabel('X/c (in)')
ylabel('Pressure (psi)')
title('14 Deg. AOA Pressure vs. X/c')
grid on
hold off

% Cp vs. x/c @ AoA = 14
q =3.64*10^1 * 1/144 % psi

Cp_lower = lower/q ;
Cp_upper = upper/q ;

figure(2)
plot(xOverc(1:17), Cp_lower, 'linewidth', 1)
hold on
plot(xOverc(17:32), Cp_upper, 'linewidth', 1)
legend('$C_{p,lower}$', '$C_{p,upper}$', 'Interpreter', 'latex');
xlabel('X/c (in)')
ylabel('C_p')
set(gca, 'YDir','reverse')
title('14 Deg. AOA C_p vs. X/c')
grid on
hold off

figure(3)
plot(Cp_lower, yOverc(1:17), 'linewidth', 1)
hold on
plot(Cp_upper, yOverc(17:32), 'linewidth', 1)
legend('$C_{p,lower}$', '$C_{p,upper}$', 'Interpreter', 'latex');
xlabel('C_p (in)')
ylabel('y/c')
title('14 Deg. AOA C_p vs. y/c')
grid on
hold off

% For Cp_lower
N_l = trapz(xOverc(1:17), Cp_lower);

% For Cp_upper
N_u= trapz(xOverc(17:32), Cp_upper);

% Solve for C_N
c_bar = 8/4 %c/4
C_N_14 = (N_u + N_l)
```

```
% Solve for C_c
% N_l_cc = trapz(Cp_lower,yOverc(1:17))
% N_u_cc = trapz(Cp_upper,yOverc(17:32))
N_l_cc = trapz(yOverc(1:17),Cp_lower)
N_u_cc = trapz(yOverc(17:32),Cp_upper)
C_N_14_cc = N_l_cc+N_u_cc
```

q =

    0.2528

c_bar =

    2

C_N_14 =

    0.9973

N_l_cc =

   -0.0661

N_u_cc =

    0.0878

C_N_14_cc =

    0.0216

14 Deg. AOA Pressure vs. X/c

14 Deg. AOA C_p vs. X/c

14 Deg. AOA C_p vs. y/c
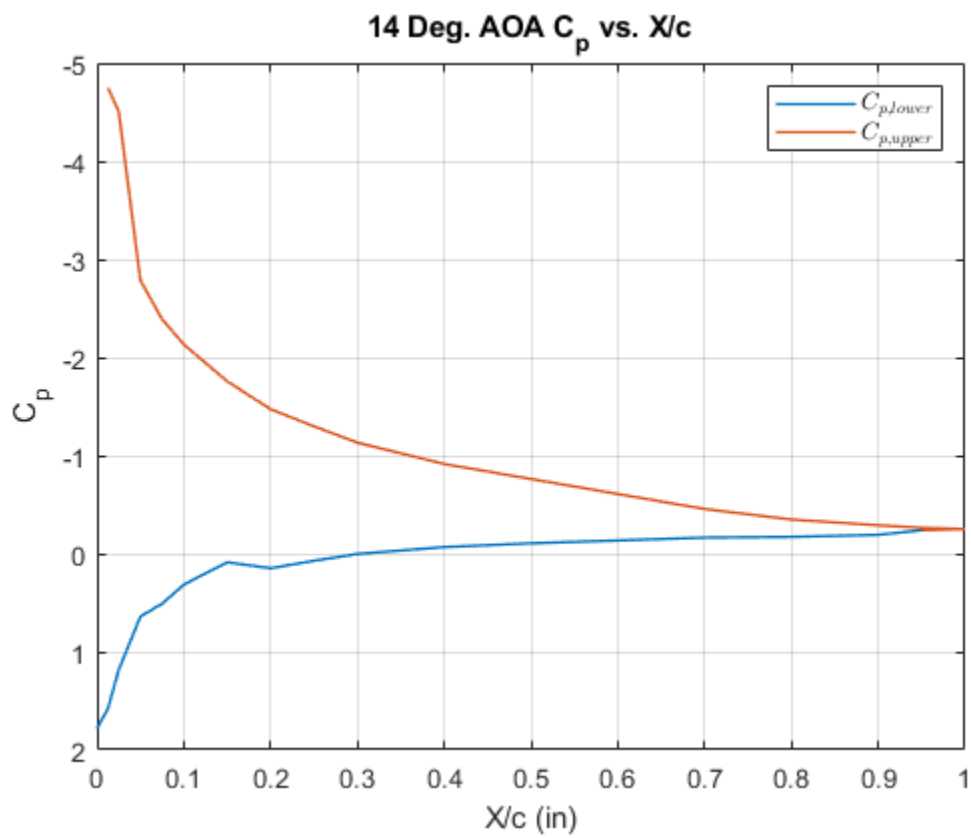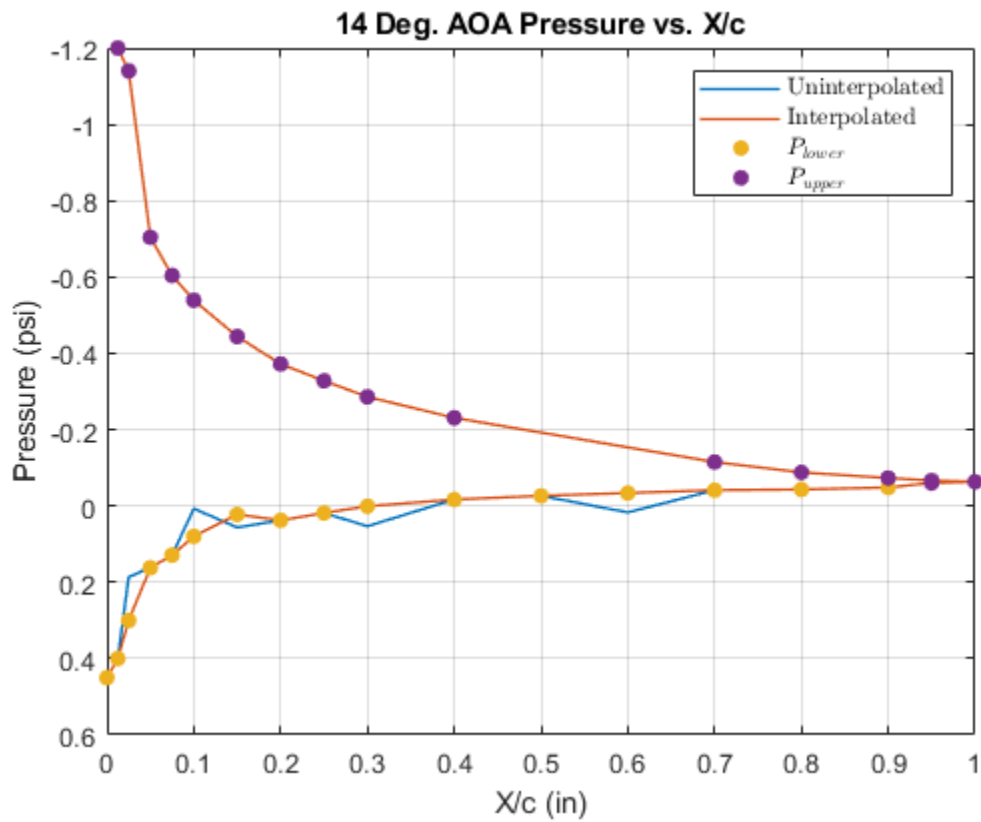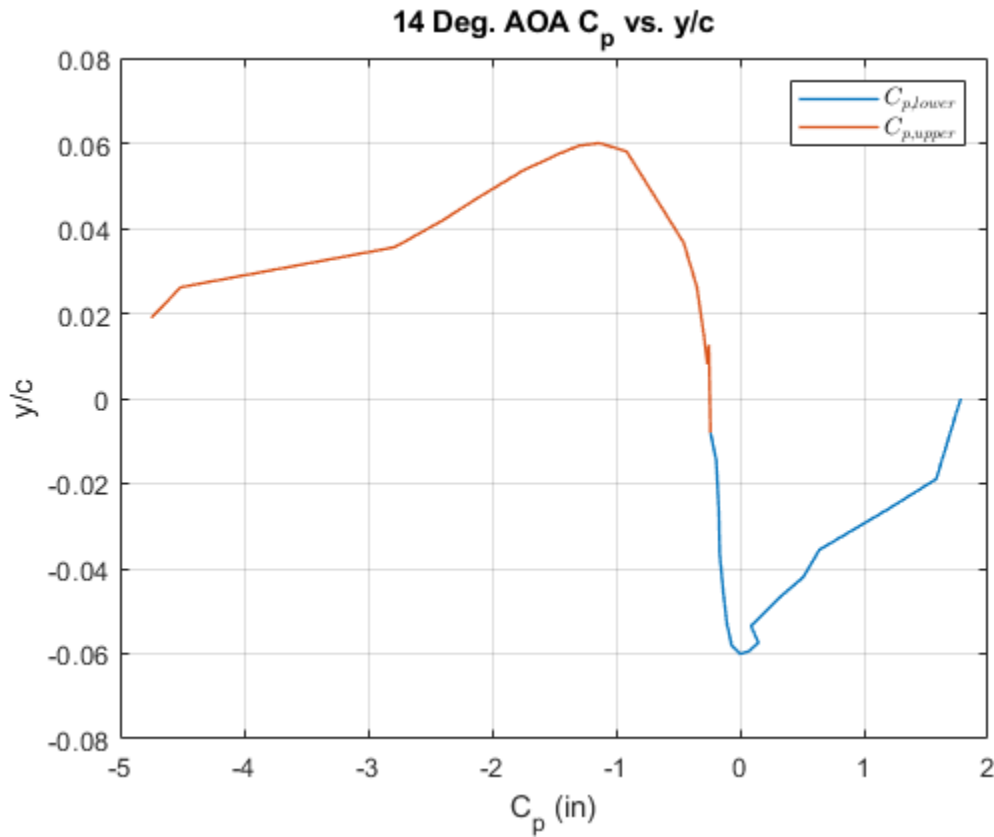
AOA 15

```
p15 = [-1.12E+00    1.23E-01    1.87E-01    1.71E-01    1.40E-01...
    7.95E-03    6.75E-02    4.74E-02    2.64E-02    5.37E-02    -1.19E-02...
    -2.35E-02    1.75E-02    -4.24E-02    -4.71E-02    -5.64E-02
-0.07202387...
    -0.08122587    -0.08298969    -0.08683395    -0.09458447
-0.1116767    -0.2277575...
    -0.2890444    -0.3330593    -0.3824387    -0.458725    -0.5633645
-0.6363668...
    -0.7578778    -1.258541    -1.311262];

p15unfixed = p15;

for i = 3:29
    if (p15(i) - p15(i-1)) > 0.03
        p15(i) = (p15(i-1) + p15(i+1))/2;
    end
end

p15(1) = 0.5; p15(2) = 0.43; p15(3) = 0.35; p15(6) = 0.05;
p15unfixed(1) = 0.45; p15unfixed(2) = 0.4; p15(10) = 0;

lower = p15(1:17);
upper = p15(17:32);
```

```matlab
figure(1)
plot(xOverc, p15unfixed, 'linewidth', 1)
hold on
plot(xOverc, p15, 'linewidth', 1)
scatter(xOverc(1:17), lower, 'filled')
scatter(xOverc(17:32), upper, 'filled')
set(gca, 'YDir','reverse')
legend({'Uninterpolated', 'Interpolated', '$P_{lower}$', '$P_{upper}$'}, ...
'Interpreter', 'latex');
xlabel('X/c (in)')
ylabel('Pressure (psi)')
title('15 Deg. AOA Pressure vs. X/c')
grid on
hold off

% Cp vs. x/c @ AoA = 15
q =3.64*10^1 * 1/144 % psi

Cp_lower = lower/q ;
Cp_upper = upper/q ;

figure(2)
plot(xOverc(1:17), Cp_lower, 'linewidth', 1)
hold on
plot(xOverc(17:32), Cp_upper, 'linewidth', 1)
legend('$C_{p,lower}$', '$C_{p,upper}$', 'Interpreter', 'latex');
xlabel('X/c (in)')
ylabel('C_p')
set(gca, 'YDir','reverse')
title('15 Deg. AOA C_p vs. X/c')
grid on
hold off

figure(3)
plot(Cp_lower, yOverc(1:17), 'linewidth', 1)
hold on
plot(Cp_upper, yOverc(17:32), 'linewidth', 1)
legend('$C_{p,lower}$', '$C_{p,upper}$', 'Interpreter', 'latex');
xlabel('C_p (in)')
ylabel('y/c')
title('15 Deg. AOA C_p vs. y/c')
grid on
hold off

% For Cp_lower
N_l = trapz(xOverc(1:17), Cp_lower);

% For Cp_upper
N_u= trapz(xOverc(17:32), Cp_upper);

% Solve for C_N
c_bar = 8/4 %c/4
C_N_15 = (N_u + N_l)
```

```
% Solve for C_c
% N_l_cc = trapz(Cp_lower,yOverc(1:17))
% N_u_cc = trapz(Cp_upper,yOverc(17:32))
N_l_cc = trapz(yOverc(1:17),Cp_lower)
N_u_cc = trapz(yOverc(17:32),Cp_upper)
C_N_15_cc = N_l_cc+N_u_cc
```

q =

   0.2528
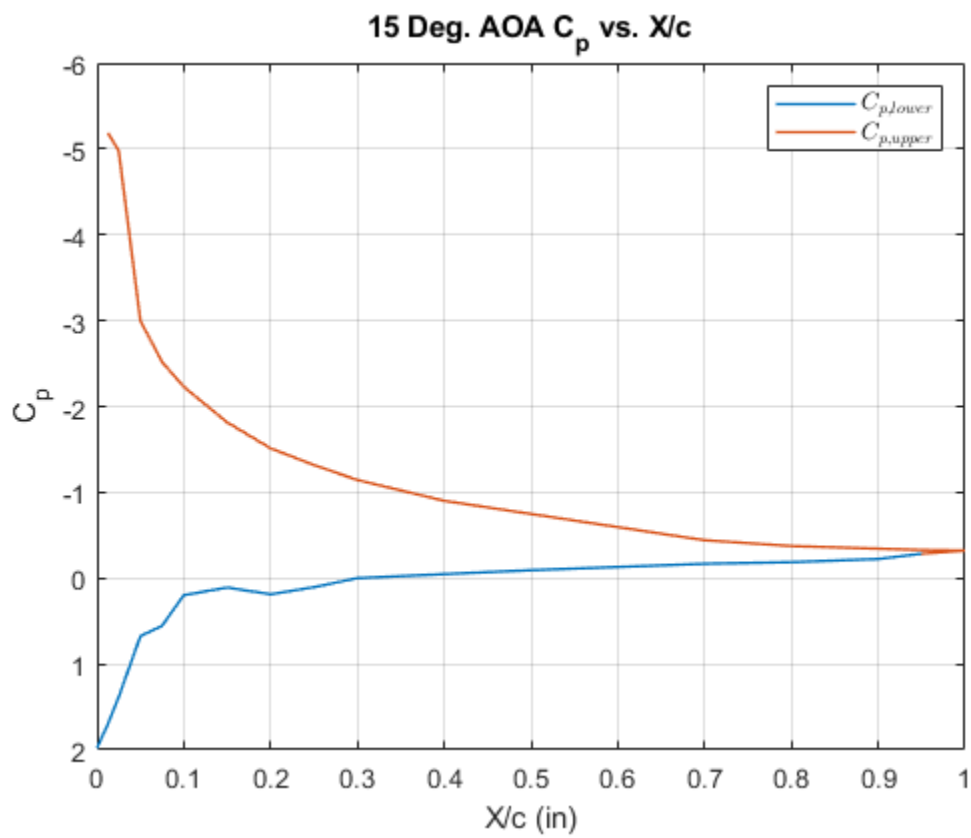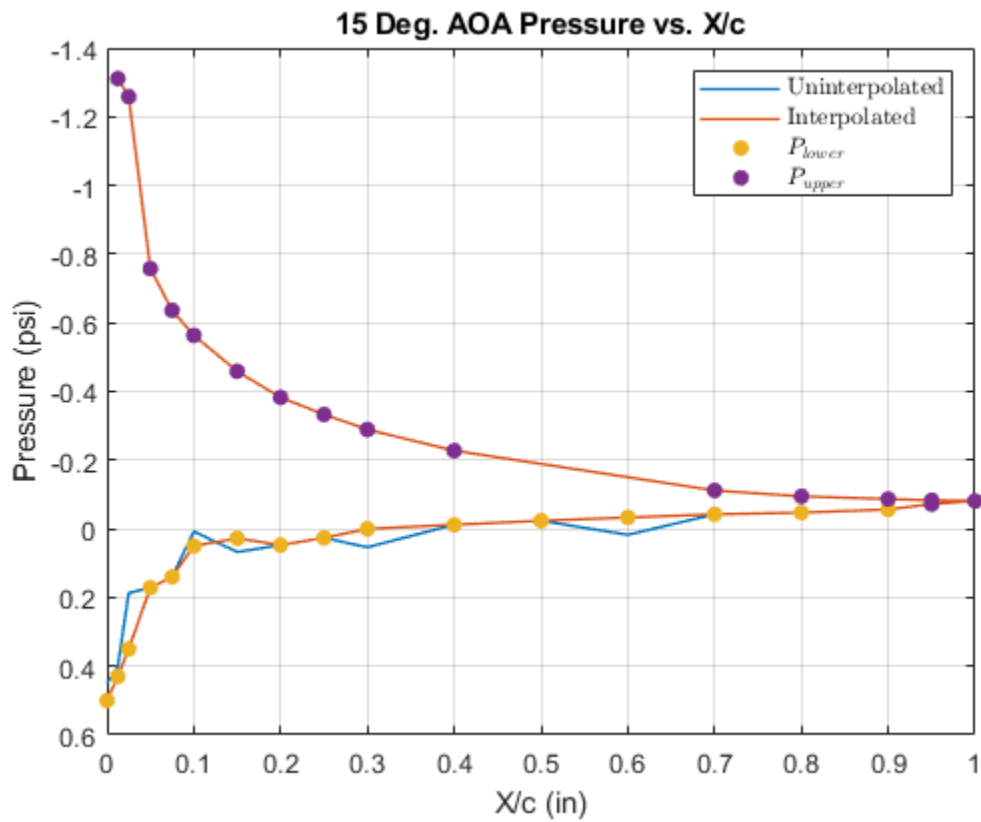

c_bar =

    2

C_N_15 =

   1.0378

N_l_cc =
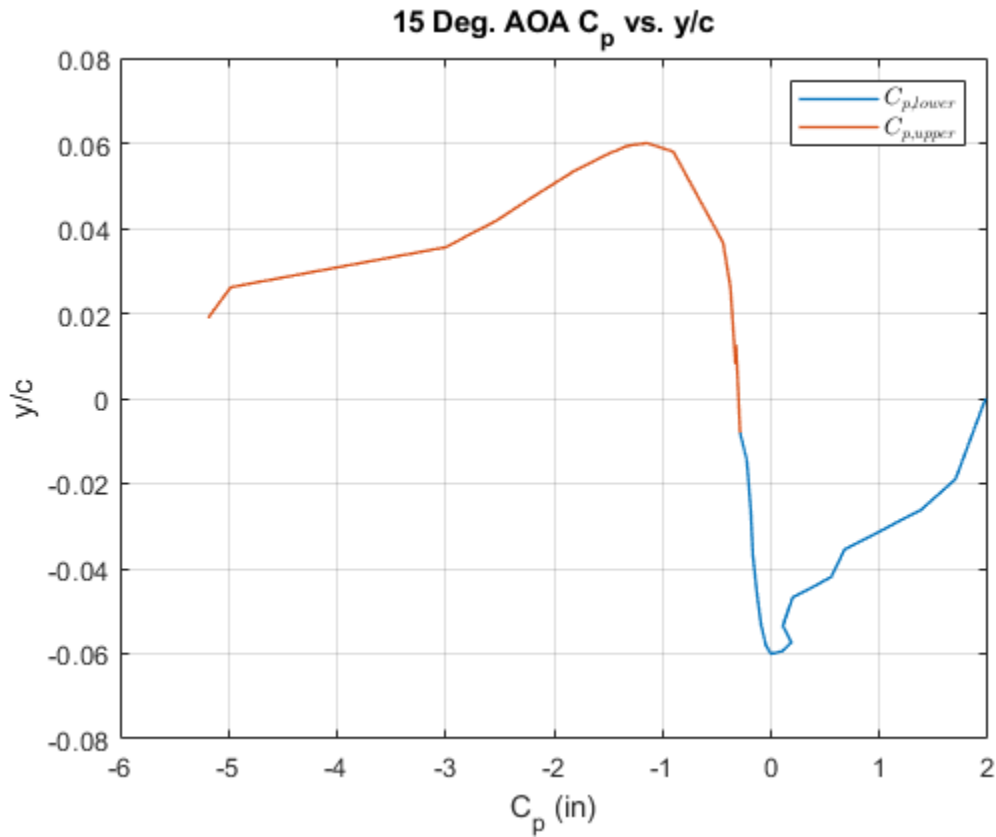
  -0.0718

N_u_cc =

   0.0951

C_N_15_cc =

   0.0233

15 Deg. AOA Pressure vs. X/c

15 Deg. AOA C$_p$ vs. X/c

15 Deg. AOA C_p vs. y/c

AOA 16

```
p16 = [-1.07E+00    1.21E-01    1.84E-01    1.68E-01    1.37E-01...
    8.29E-03    6.59E-02    4.60E-02    2.48E-02    5.41E-02    -1.55E-02...
    -2.82E-02    1.79E-02    -5.28E-02    -6.19E-02    -7.95E-02
-1.07E-01...
    -1.23E-01    -1.42E-01    -1.53E-01    -1.65E-01    -1.80E-01
-1.87E-01...
    -2.02E-01    -2.32E-01    -2.80E-01    -3.59E-01    -4.65E-01
-5.39E-01...
    -6.50E-01    -1.12E+00    -1.15E+00];

p16unfixed = p16;

for i = 3:29
    if (p16(i) - p16(i-1)) > 0.03
        p16(i) = (p16(i-1) + p16(i+1))/2;
    end
end

p16(1) = 0.5; p16(2) = 0.43; p16(3) = 0.35; p16(6) = 0.05;
p16unfixed(1) = 0.45; p16unfixed(2) = 0.4; p16(10) = 0;

lower = p16(1:17);
upper = p16(17:32);
```

```matlab
figure(1)
plot(xOverc, p16unfixed, 'linewidth', 1)
hold on
plot(xOverc, p16, 'linewidth', 1)
scatter(xOverc(1:17), lower, 'filled')
scatter(xOverc(17:32), upper, 'filled')
set(gca, 'YDir','reverse')
legend({'Uninterpolated', 'Interpolated', '$P_{lower}$', '$P_{upper}$'},
'Interpreter', 'latex');
xlabel('X/c (in)')
ylabel('Pressure (psi)')
title('16 Deg. AOA Pressure vs. X/c')
grid on
hold off

% Cp vs. x/c @ AoA = 16
q =3.64*10^1 * 1/144 % psi

Cp_lower = lower/q ;
Cp_upper = upper/q ;

figure(2)
plot(xOverc(1:17), Cp_lower, 'linewidth', 1)
hold on
plot(xOverc(17:32), Cp_upper, 'linewidth', 1)
legend('$C_{p,lower}$', '$C_{p,upper}$', 'Interpreter', 'latex');
xlabel('X/c (in)')
ylabel('C_p')
set(gca, 'YDir','reverse')
title('16 Deg. AOA C_p vs. X/c')
grid on
hold off

figure(3)
plot(Cp_lower, yOverc(1:17), 'linewidth', 1)
hold on
plot(Cp_upper, yOverc(17:32), 'linewidth', 1)
legend('$C_{p,lower}$', '$C_{p,upper}$', 'Interpreter', 'latex');
xlabel('C_p (in)')
ylabel('y/c')
title('16 Deg. AOA C_p vs. y/c')
grid on
hold off

% For Cp_lower
N_l = trapz(xOverc(1:17), Cp_lower);

% For Cp_upper
N_u= trapz(xOverc(17:32), Cp_upper);

% Solve for C_N
c_bar = 8/4 %c/4
C_N_16 = (N_u + N_l)
```

```
% Solve for C_c
% N_l_cc = trapz(Cp_lower,yOverc(1:17))
% N_u_cc = trapz(Cp_upper,yOverc(17:32))
N_l_cc = trapz(yOverc(1:17),Cp_lower)
N_u_cc = trapz(yOverc(17:32),Cp_upper)
C_N_16_cc = N_l_cc+N_u_cc
```

q =
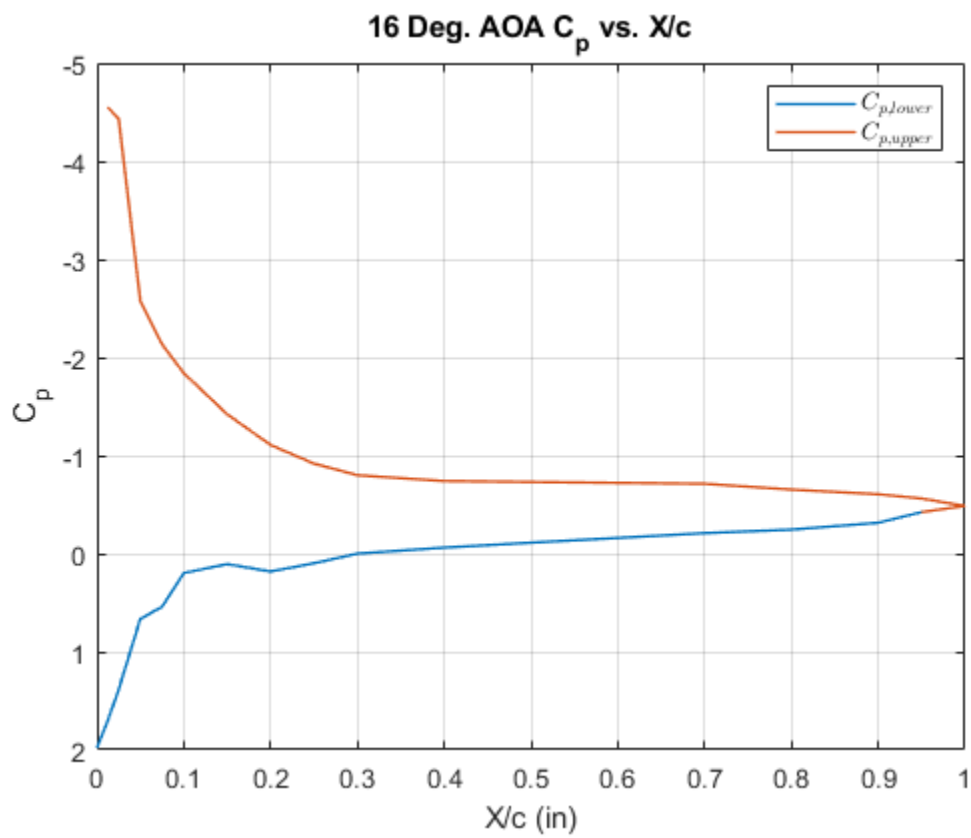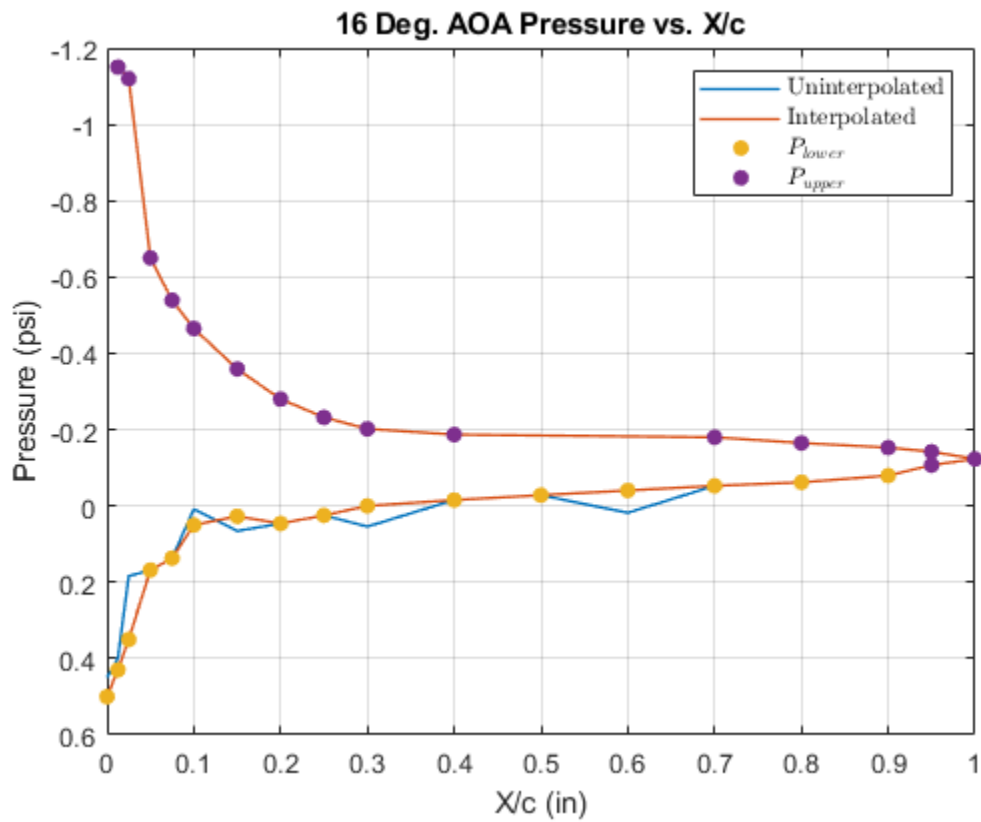
0.2528
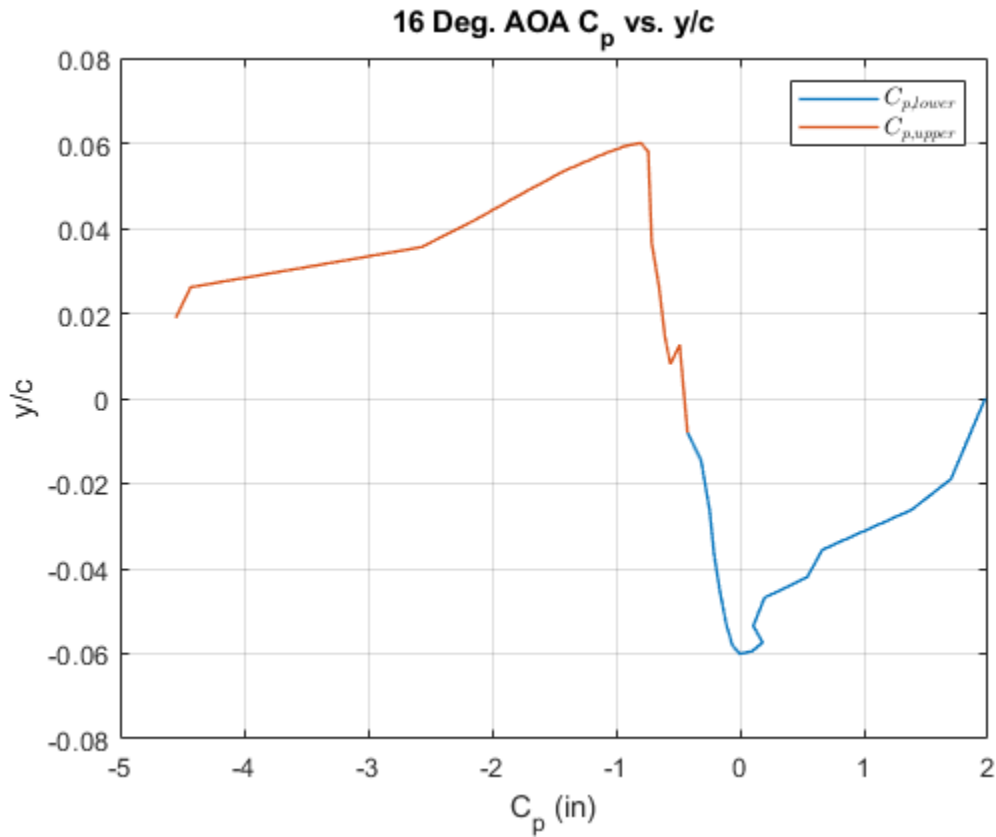
c_bar =

2

C_N_16 =

0.9525

N_l_cc =

-0.0743

N_u_cc =

0.0661

C_N_16_cc =

-0.0083

16 Deg. AOA Pressure vs. X/c

16 Deg. AOA C_p vs. X/c

16 Deg. AOA C$_p$ vs. y/c

AOA 17

```
p17 = [-1.92E-01    1.86E-01    1.71E-01    1.26E-01    9.33E-02...
    4.46E-03    2.61E-02    1.08E-02    -8.00E-03    5.35E-02    -4.48E-02...
    -5.70E-02    1.84E-02    -8.59E-02    -9.93E-02    -1.22E-01
-1.54E-01...
    -1.99E-01    -2.13E-01    -2.24E-01    -2.29E-01    -2.32E-01
-2.12E-01...
    -2.05E-01    -2.03E-01    -1.99E-01    -1.97E-01    -1.97E-01
-1.92E-01...
    -1.97E-01    -1.95E-01    -1.93E-01];

p17unfixed = p17;

for i = 3:29
    if (p17(i) - p17(i-1)) > 0.03
        p17(i) = (p17(i-1) + p17(i+1))/2;
    end
end

p17(6) = 0.05;
p17(1) = 0.25;
p17unfixed(1) = 0.25;

lower = p17(1:17);
```

```matlab
upper = p17(17:32);

figure(1)
plot(xOverc, p17unfixed, 'linewidth', 1)
hold on
plot(xOverc, p17, 'linewidth', 1)
scatter(xOverc(1:17), lower, 'filled')
scatter(xOverc(17:32), upper, 'filled')
set(gca, 'YDir','reverse')
legend({'Uninterpolated', 'Interpolated', '$P_{lower}$', '$P_{upper}$'},
'Interpreter', 'latex');
xlabel('X/c (in)')
ylabel('Pressure (psi)')
title('17 Deg. AOA Pressure vs. X/c')
grid on
hold off

% Cp vs. x/c @ AoA = 17
q =3.64*10^1 * 1/144 % psi

Cp_lower = lower/q ;
Cp_upper = upper/q ;

figure(2)
plot(xOverc(1:17), Cp_lower, 'linewidth', 1)
hold on
plot(xOverc(17:32), Cp_upper, 'linewidth', 1)
legend('$C_{p,lower}$', '$C_{p,upper}$', 'Interpreter', 'latex');
xlabel('X/c (in)')
ylabel('C_p')
title('17 Deg. AOA C_p vs. X/c')
set(gca, 'YDir','reverse')
grid on
hold off

figure(3)
plot(Cp_lower, yOverc(1:17), 'linewidth', 1)
hold on
plot(Cp_upper, yOverc(17:32), 'linewidth', 1)
legend('$C_{p,lower}$', '$C_{p,upper}$', 'Interpreter', 'latex');
xlabel('C_p (in)')
ylabel('y/c')
title('17 Deg. AOA C_p vs. y/c')
grid on
hold off

% For Cp_lower
N_l = trapz(xOverc(1:17), Cp_lower);

% For Cp_upper
N_u= trapz(xOverc(17:32), Cp_upper);

% Solve for C_N
c_bar = 8/4; %c/4
```

```matlab
C_N_17 = (N_u + N_l)

% Solve for C_c
% N_l_cc = trapz(Cp_lower,yOverc(1:17))
% N_u_cc = trapz(Cp_upper,yOverc(17:32))
N_l_cc = trapz(yOverc(1:17),Cp_lower)
N_u_cc = trapz(yOverc(17:32),Cp_upper)
C_N_17_cc = N_l_cc+N_u_cc
```

q =

    0.2528

C_N_17 =

    0.6633

N_l_cc =

   -0.0508

N_u_cc =

   -0.0249

C_N_17_cc =

   -0.0757

17 Deg. AOA Pressure vs. X/c

17 Deg. AOA C_p vs. X/c

17 Deg. AOA C_p vs. y/c
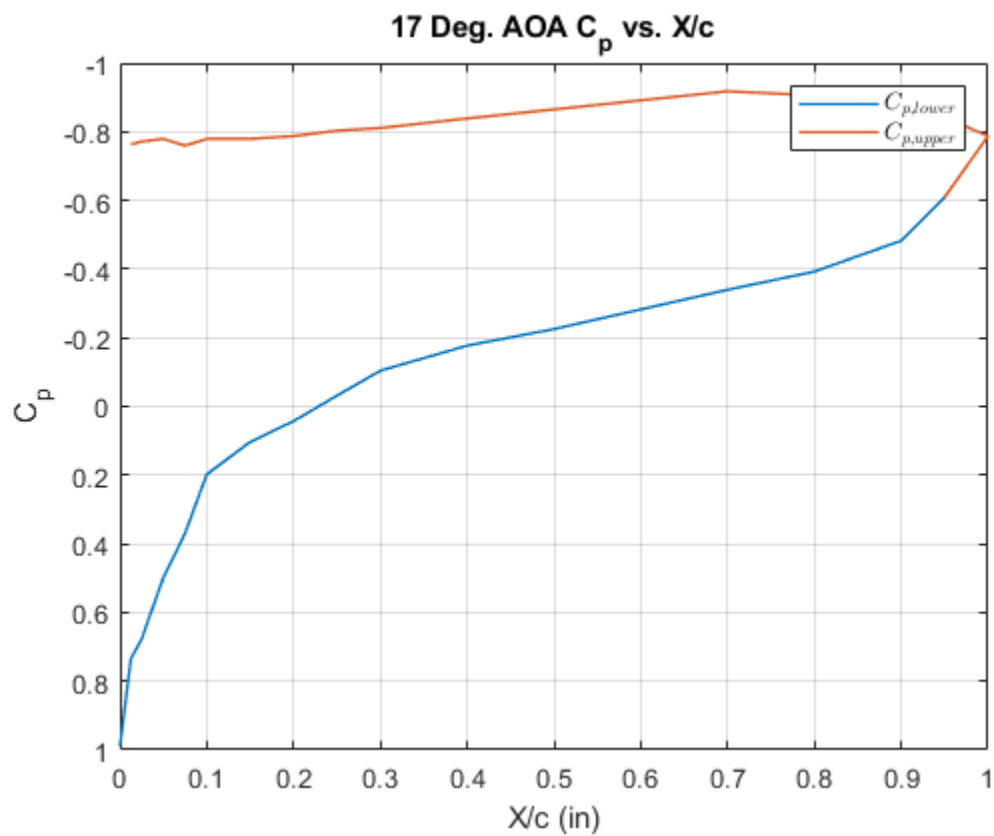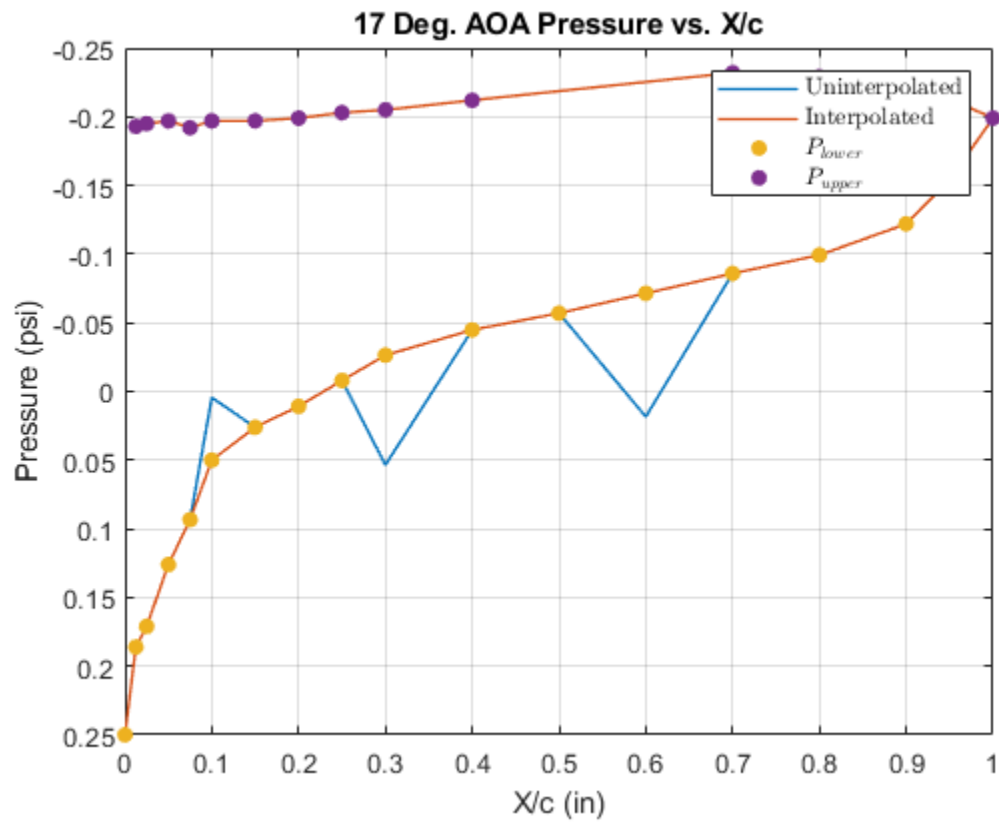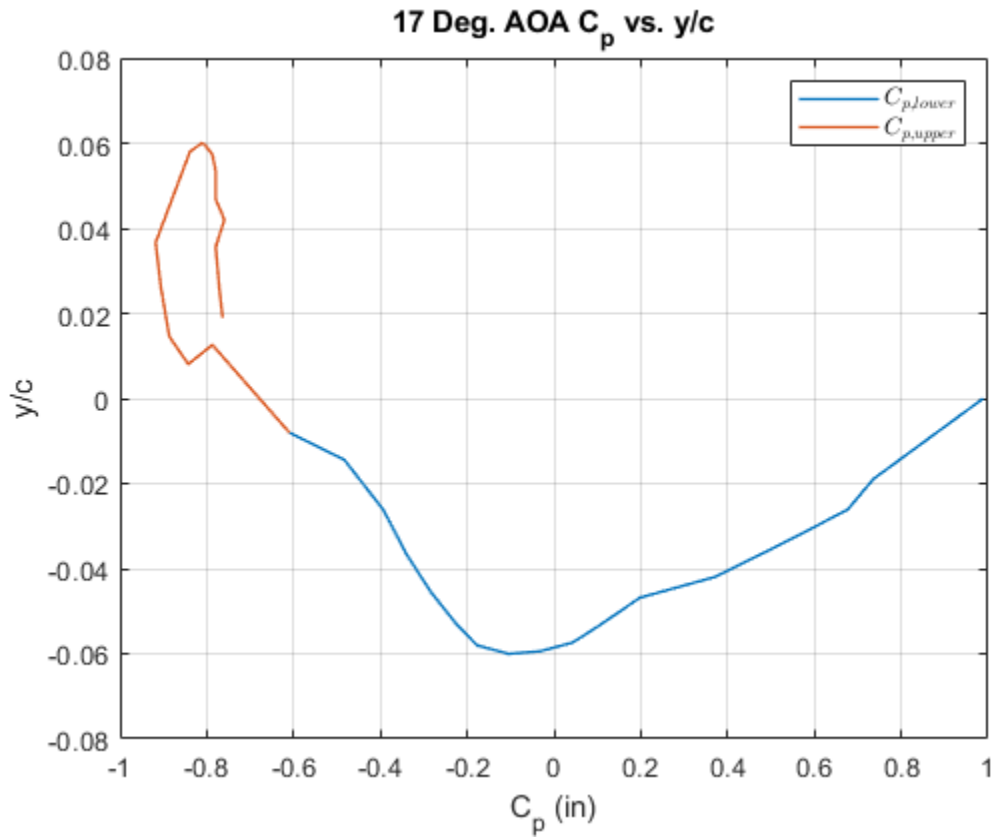
AOA 18

```
p18 = [-1.90E-01    1.91E-01    1.74E-01    1.27E-01    9.26E-02...
    3.94E-03    2.26E-02    6.91E-03  -1.32E-02    5.27E-02    -5.20E-02...
    -6.48E-02    1.90E-02    -9.53E-02    -1.09E-01    -1.33E-01
-0.1647758...
    -0.2109623    -0.2264118    -0.2381296    -0.2443881    -0.2475352...
    -0.2258458    -0.2165322  -0.2131371    -0.2094517    -0.2082829...
    -0.2077451    -0.2034602    -0.2087493    -0.2060661    -0.203908];

p18unfixed = p18;

for i = 3:29
    if (p18(i) - p18(i-1)) > 0.03
        p18(i) = (p18(i-1) + p18(i+1))/2;
    end
end

p18(6) = 0.05;
p18(1) = 0.25;
p18unfixed(1) = 0.25;

lower = p18(1:17);
upper = p18(17:32);
```

```matlab
figure(1)
plot(xOverc, p18unfixed, 'linewidth', 1)
hold on
plot(xOverc, p18, 'linewidth', 1)
scatter(xOverc(1:17), lower, 'filled')
scatter(xOverc(17:32), upper, 'filled')
legend('Uninterpolated', 'Interpolated', 'P_{lower}', 'P_{upper}',
'Interpreter', 'latex');
xlabel('X/c (in)')
ylabel('Pressure (psi)')
title('18 Deg. AOA Pressure vs. X/c')
grid on
hold off

% Cp vs. x/c @ AoA = 18
q =3.64*10^1 * 1/144 % psi

Cp_lower = lower/q ;
Cp_upper = upper/q ;

figure(2)
plot(xOverc(1:17), Cp_lower, 'linewidth', 1)
hold on
plot(xOverc(17:32), Cp_upper, 'linewidth', 1)
set(gca, 'YDir','reverse')
legend({'Uninterpolated', 'Interpolated', '$P_{lower}$', '$P_{upper}$'},
'Interpreter', 'latex');
xlabel('X/c (in)')
ylabel('C_p')
title('18 Deg. AOA C_p vs. X/c')
set(gca, 'YDir','reverse')
grid on
hold off

figure(3)
plot(Cp_lower, yOverc(1:17), 'linewidth', 1)
hold on
plot(Cp_upper, yOverc(17:32), 'linewidth', 1)
legend('$C_{p,lower}$', '$C_{p,upper}$', 'Interpreter', 'latex');
xlabel('C_p (in)')
ylabel('y/c')
title('18 Deg. AOA C_p vs. y/c')
grid on
hold off

% For Cp_lower
N_l = trapz(xOverc(1:17), Cp_lower);

% For Cp_upper
N_u= trapz(xOverc(17:32), Cp_upper);

% Solve for C_N
c_bar = 8/4; %c/4
C_N_18 = (N_u + N_l)
```

```
% Solve for C_c
% N_l_cc = trapz(Cp_lower,yOverc(1:17))
% N_u_cc = trapz(Cp_upper,yOverc(17:32))
N_l_cc = trapz(yOverc(1:17),Cp_lower)
N_u_cc = trapz(yOverc(17:32),Cp_upper)
C_N_18_cc = N_l_cc+N_u_cc
```

q =

   0.2528

Warning: Error updating Legend.

 String scalar or character vector must have valid interpreter syntax:
P_{lower}

Warning: Error updating Legend.

 String scalar or character vector must have valid interpreter syntax:
P_{upper}

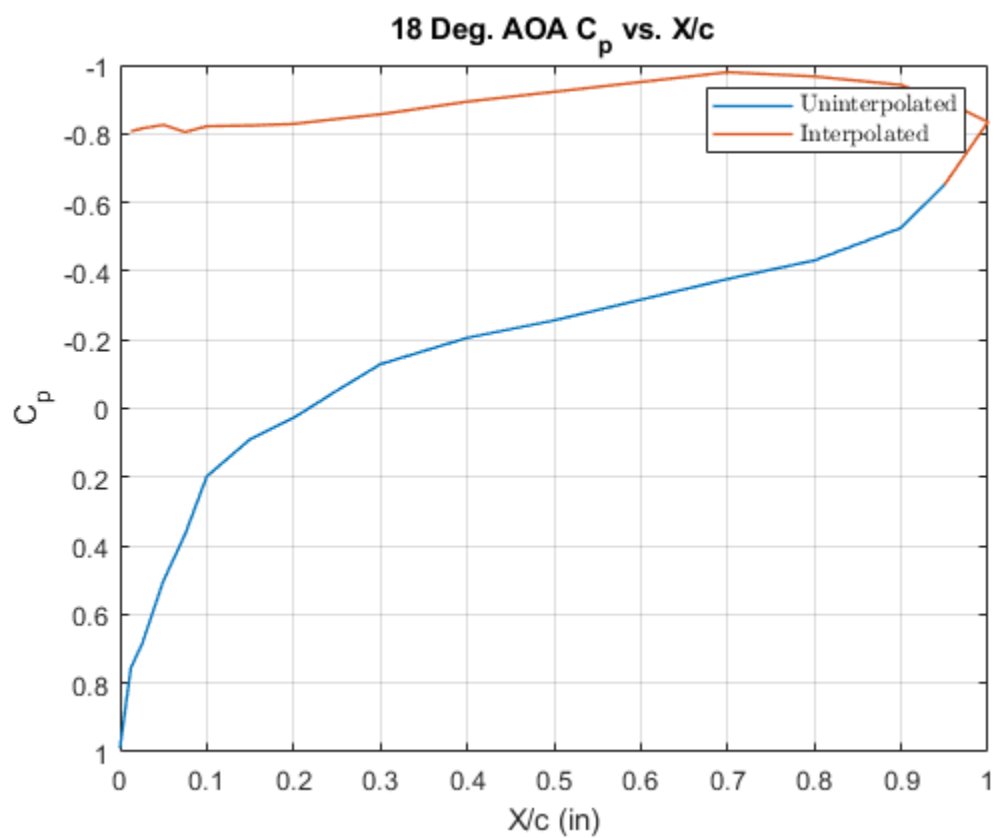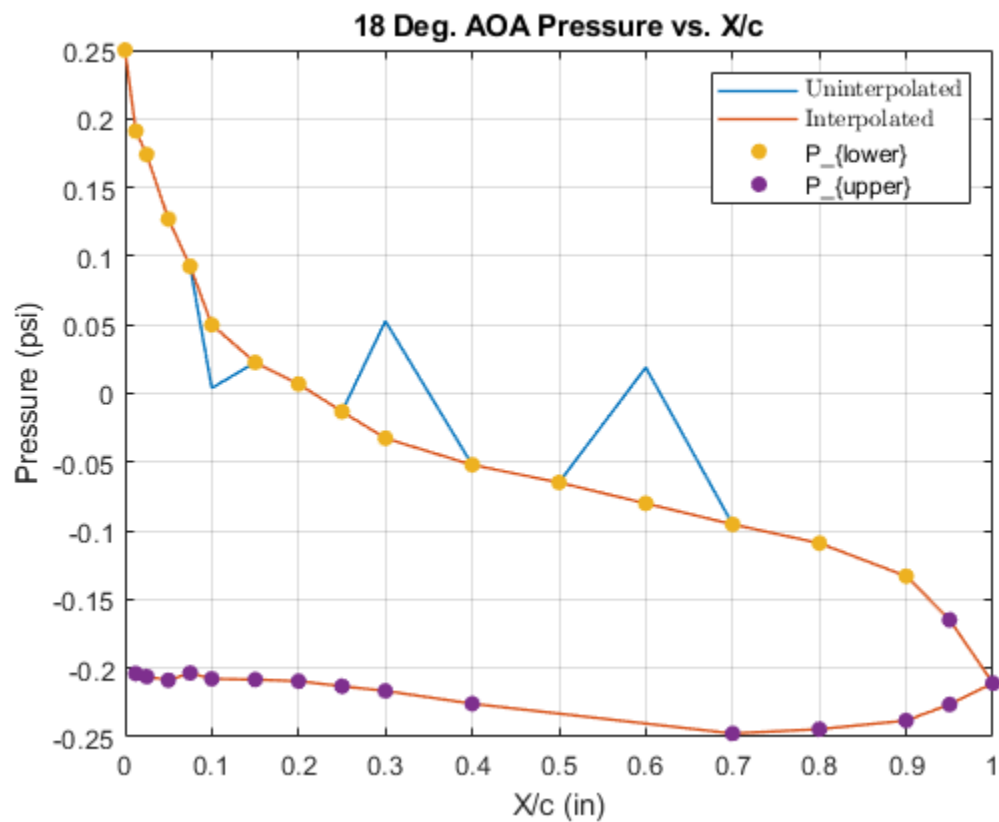*Warning: Ignoring extra legend entries.*
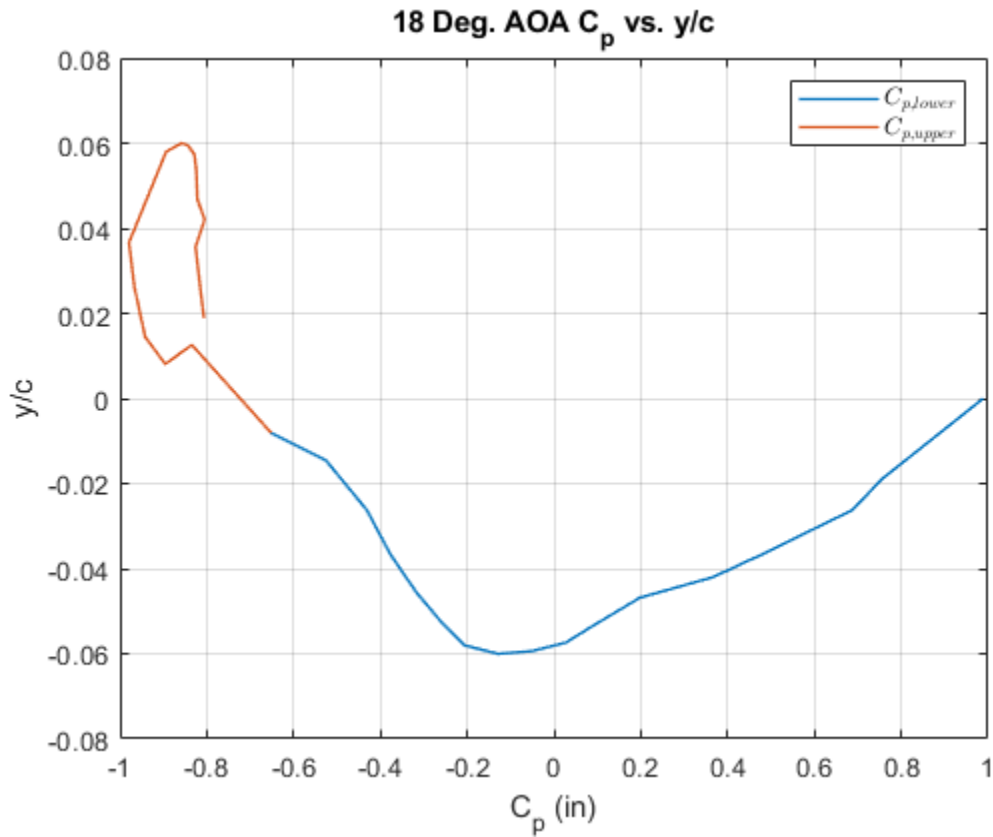
C_N_18 =

   0.6881

N_l_cc =

  -0.0529

N_u_cc =

  -0.0268

C_N_18_cc =

  -0.0797

18 Deg. AOA Pressure vs. X/c

18 Deg. AOA C_p vs. X/c

18 Deg. AOA C_p vs. y/c

C_L plots

```
C_N = [C_N_neg4 C_N_0 C_N_4 C_N_8 C_N_10 C_N_12 C_N_13 C_N_14 C_N_15 C_N_16
C_N_17 C_N_18]

AoA = [ -4 0 4 8 10 12 13 14 15 16 17 18]

%Initialze a 1x12 Matrix for C_l
C_l = zeros(1,12)

for i = 1:12
    C_l(i) = C_N(i)*cosd(AoA(i));
end

figure(5)
hold on
plot(AoA, C_l, 'linewidth', 1)
legend('V = 180 fps')
xlabel('AoA (deg)')
ylabel('C_l')
title('Coefficient of Lift (C_L) vs. AoA(alpha)')
grid on
hold off


C_N =
```

Columns 1 through 7

 -0.6008   -0.1610   0.2437   0.6508   0.7736   0.9234   0.9535

Columns 8 through 12

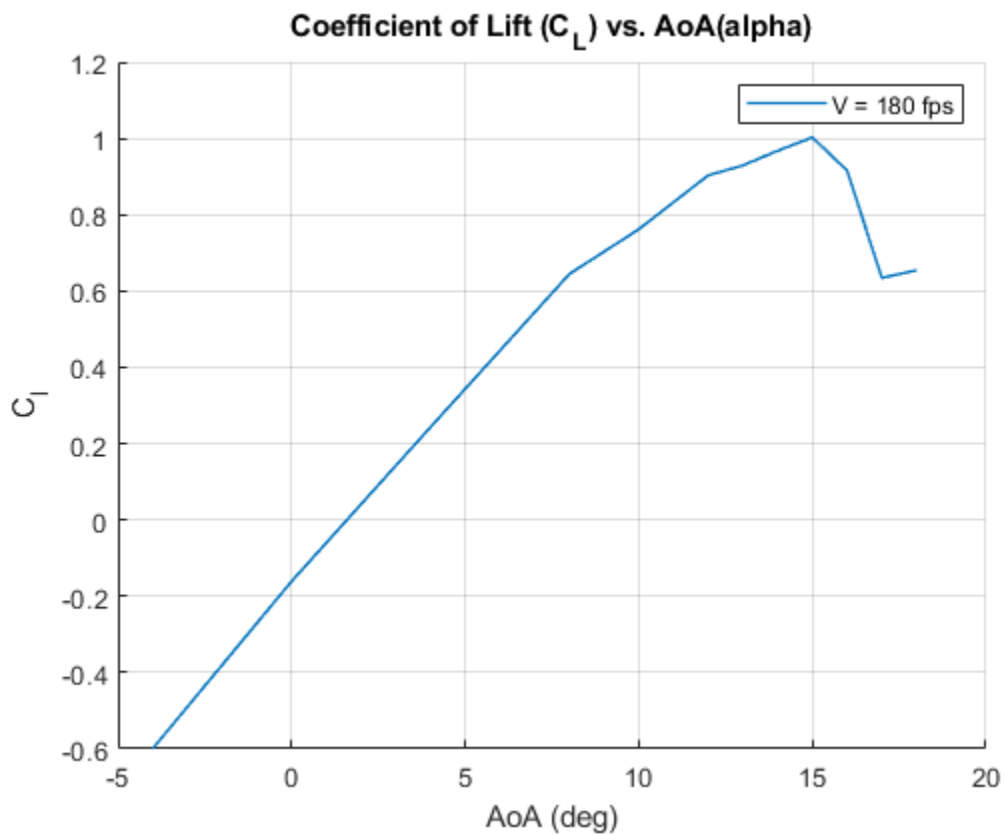 *0.9973   1.0378   0.9525   0.6633   0.6881*

AoA =

 -4   0   4   8   10   12   13   14   15   16   17   18

C_l =

 0   0   0   0   0   0   0   0   0   0   0   0

Coefficient of Lift (C$_L$) vs. AoA(alpha)

C_d plots

```
yOverc = [0      -0.01894     -0.02615     -0.03555     -0.042      -0.04683
-0.05345...
    -0.05737     -0.05941     -0.06002     -0.05803     -0.05294     -0.04563
-0.03664...
```

```
   -0.02623    -0.01448    -0.00807    0.0126    0.00807    0.01448
0.02623    0.03664    0.05803...
   0.06002    0.05941    0.05737    0.05345    0.04683    0.042
0.03555    0.02615    0.01894];

Cc = trapz(Cp_lower,yOverc(1:17)) + trapz(Cp_upper,yOverc(17:32))

AoA = [ -4 0 4 8 10 12 13 14 15 16 17 18];

%Initialize a 1x12 Matrix for C_D
for i = 1:12
    C_D(i) = Cc*cosd(AoA(i)) + C_N(i)*sind(AoA(i));
end

figure(6)
hold on
plot(AoA, C_D, 'linewidth', 1)
xlabel('AoA (deg)')
ylabel('C_D')
title('Coefficient of Drag (C_D) vs. AoA(alpha)')
legend('V = 180 fps','Location','Northwest')
grid on
hold off


Cc =

    0.0644
```
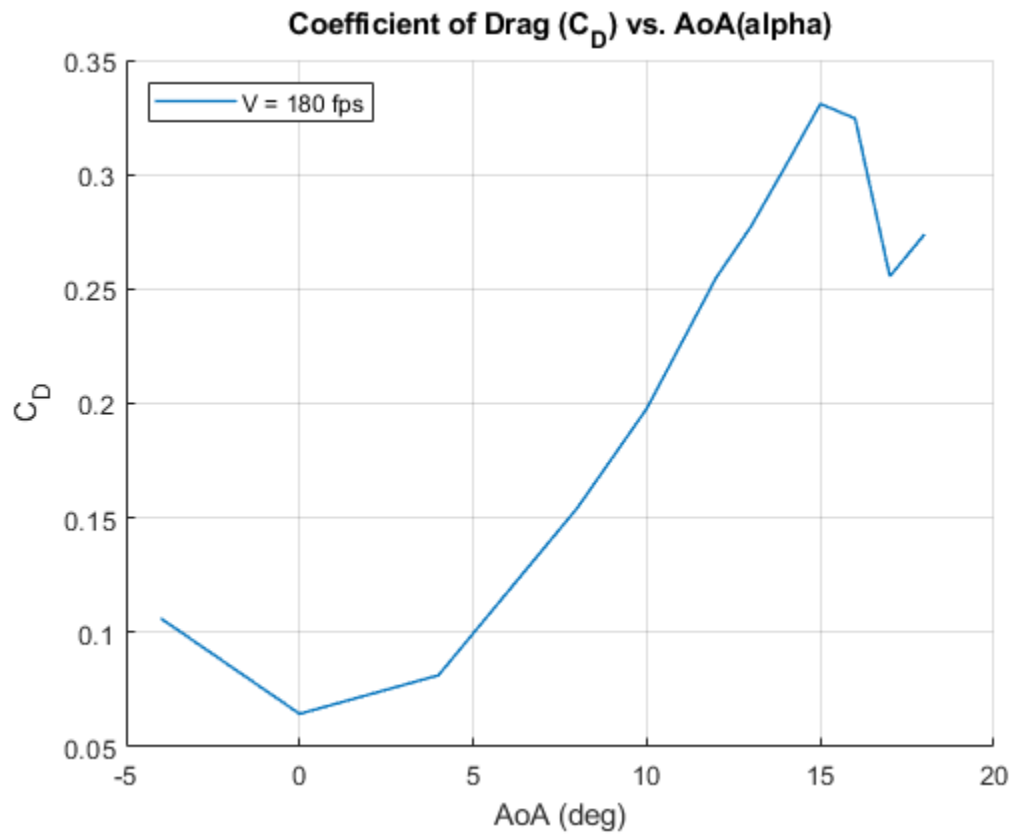
Coefficient of Drag (C_D) vs. AoA(alpha)

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