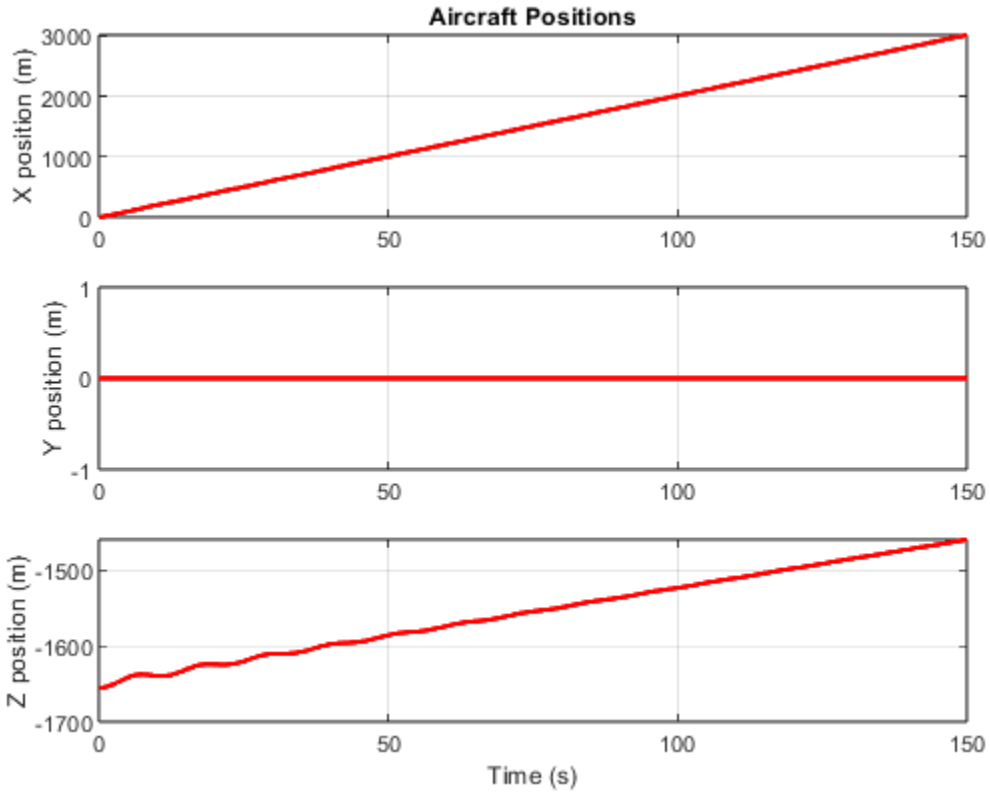
Problem 3 Code Appendix

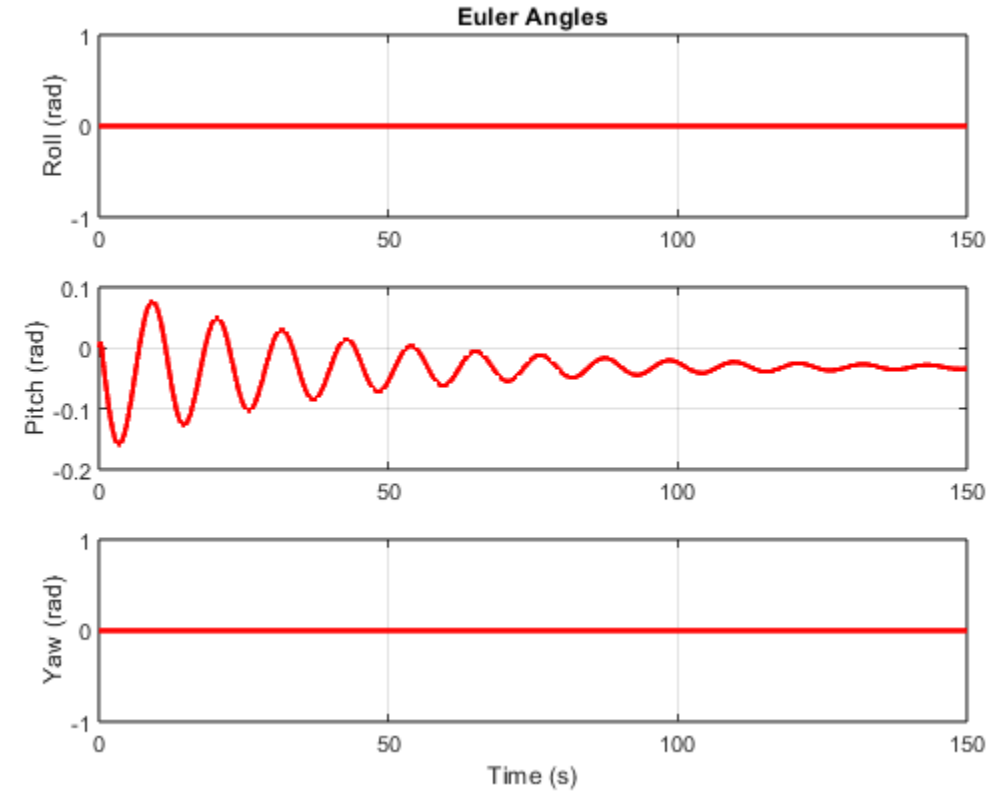
```
close all; clear; clc;
ttwistor;
```

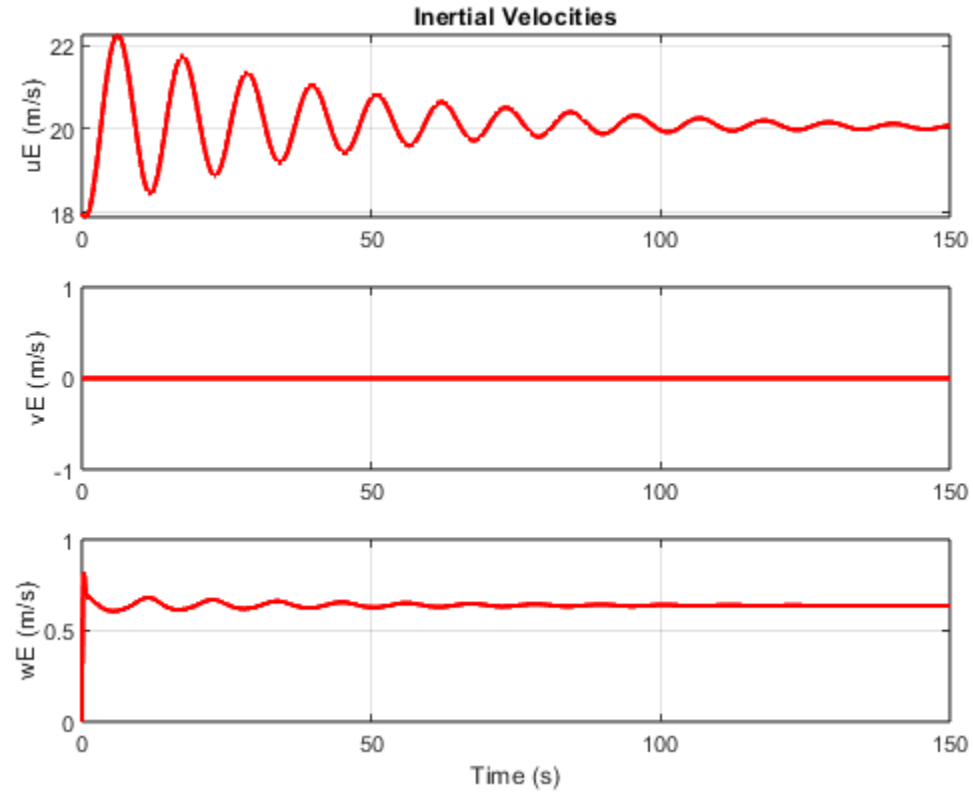
Problem 2/3

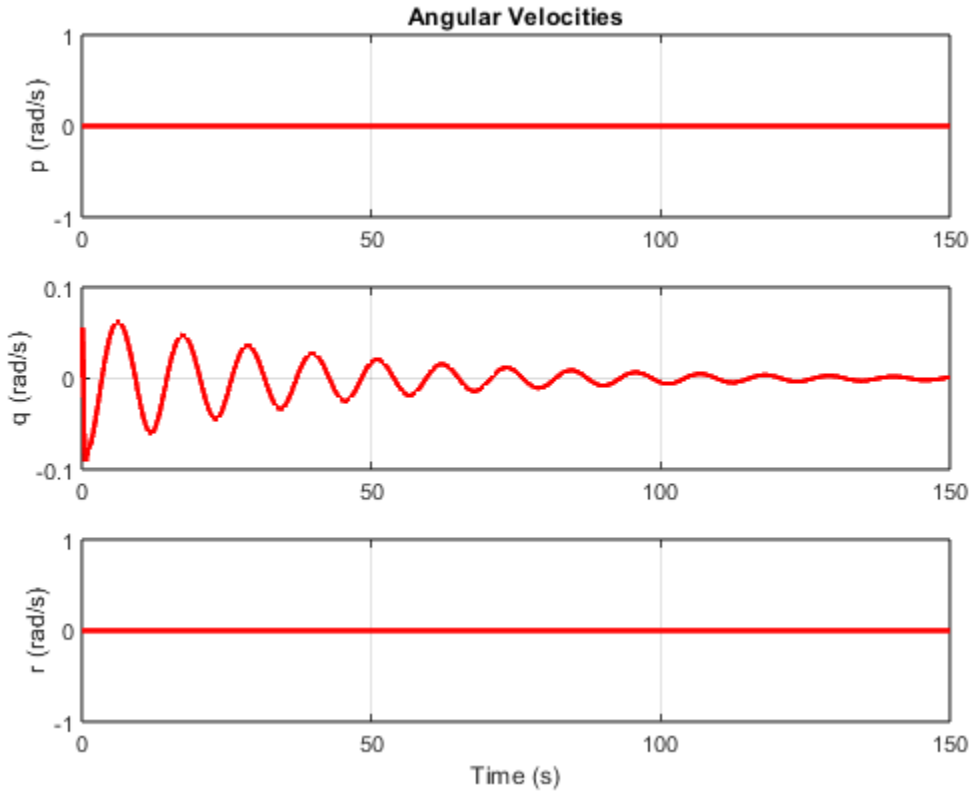
Problem 3

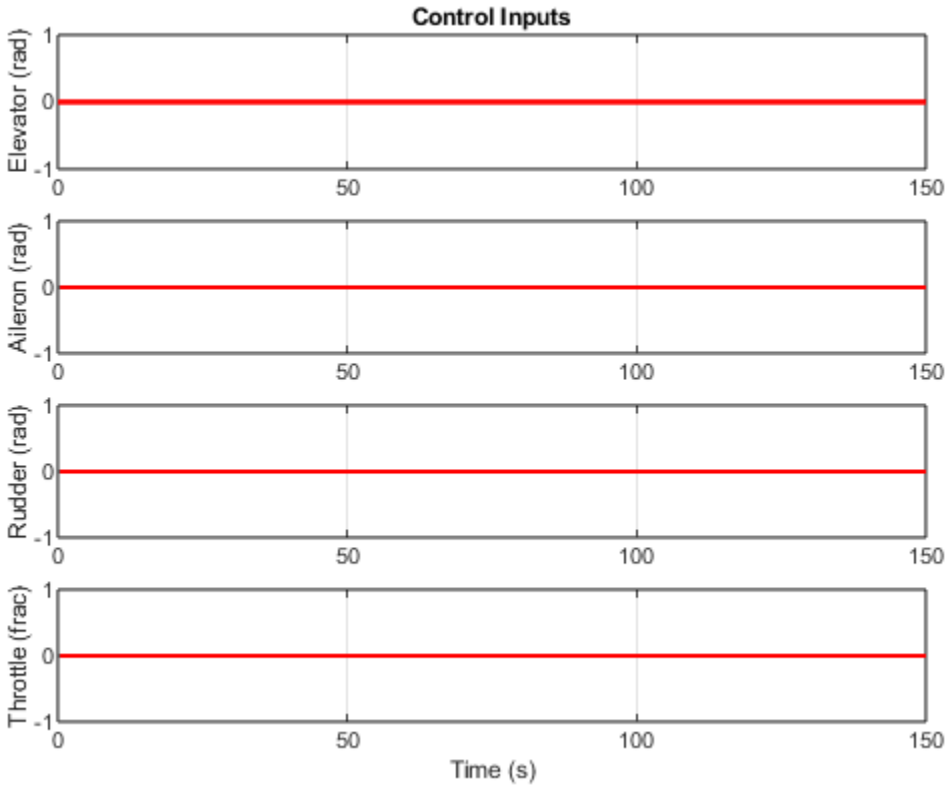
```
V = WindAnglesToAirRelativeVelocityVector([18; 0; 0]);
VE = TransformFromBodyToInertial(V, [0; 0; 0]);
wind_inertial = [0; 0; 0];
h = 1655;
init_state = [0; 0; -h; 0; 0; 0; VE(1); VE(2); VE(3); 0; 0; 0];
aircraft_surfaces = [0; 0; 0; 0];
rho = stdatmo(h);

% Problem 2
xDot_problem2 = AircraftEOM(0, init_state, aircraft_surfaces, wind_inertial,
aircraft_parameters);

% Aircraft Simulation
tspan = [0 150];
odeFunc = @(time, aircraft_state)AircraftEOM(time, aircraft_state,
aircraft_surfaces, wind_inertial, aircraft_parameters);
[Tout, Xout] = ode45(odeFunc, tspan, init_state);

Uout = zeros(length(Tout),4);
for i=1:length(Tout)
    Uout(i,:) = aircraft_surfaces';
end

PlotSimulation(Tout, Xout, Uout, 1:6, 'r');
```

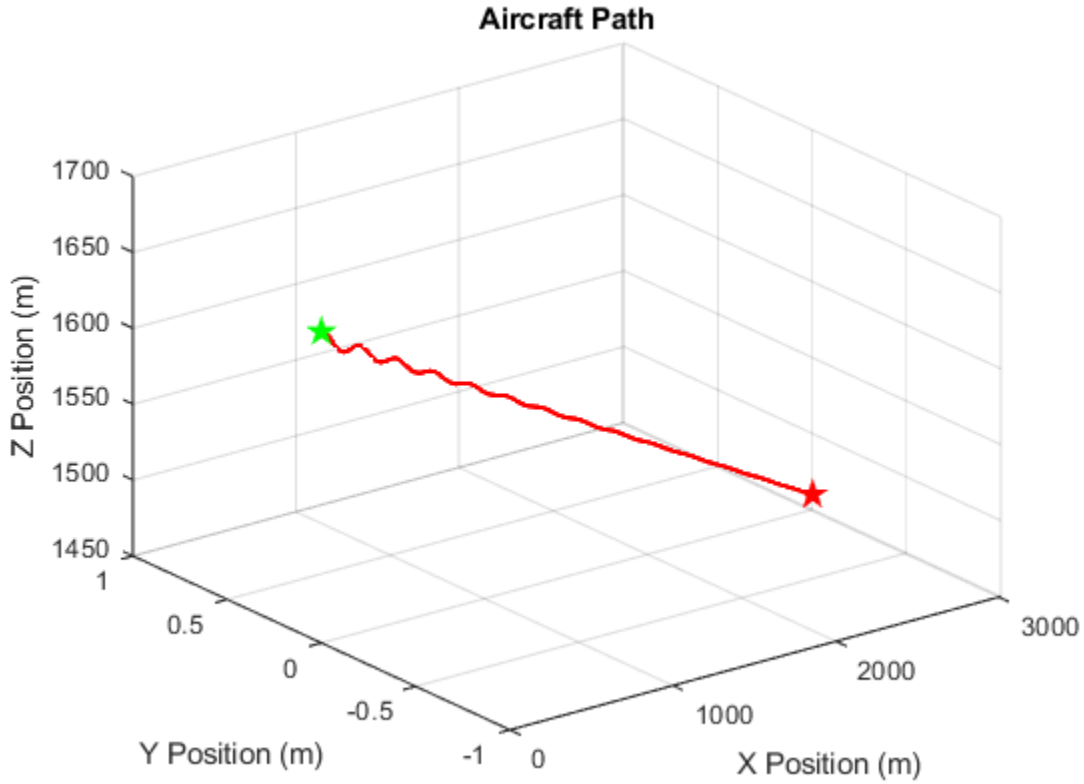

Aircraft Positions
X position (m)
3000
2000
1000
0
Y position (m)
1
0
-1
Z position (m)
-1500
-1600
-1700
0
50
100
150
Time (s)


Euler Angles
Roll (rad)
1
0
-1
Pitch (rad)
0.1
0
-0.1
-0.2
Yaw (rad)
0
50
100
150
Time (s)


Inertial Velocities
uE (m/s)
22
20
18
vE (m/s)
1
0
-1
wE (m/s)
1
0.5
0
0
50
100
150
Time (s)

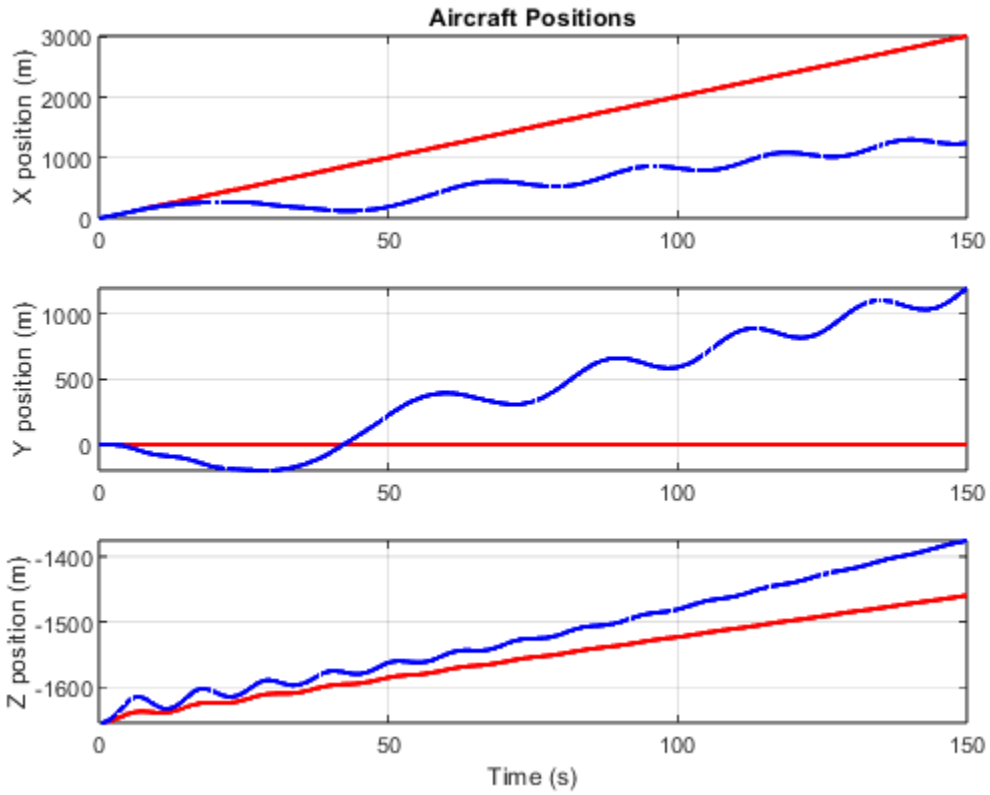

Angular Velocities
p (rad/s)
1
0
-1
q (rad/s)
0.1
0
-0.1
r (rad/s)
1
0
-1
0
50
100
150
Time (s)

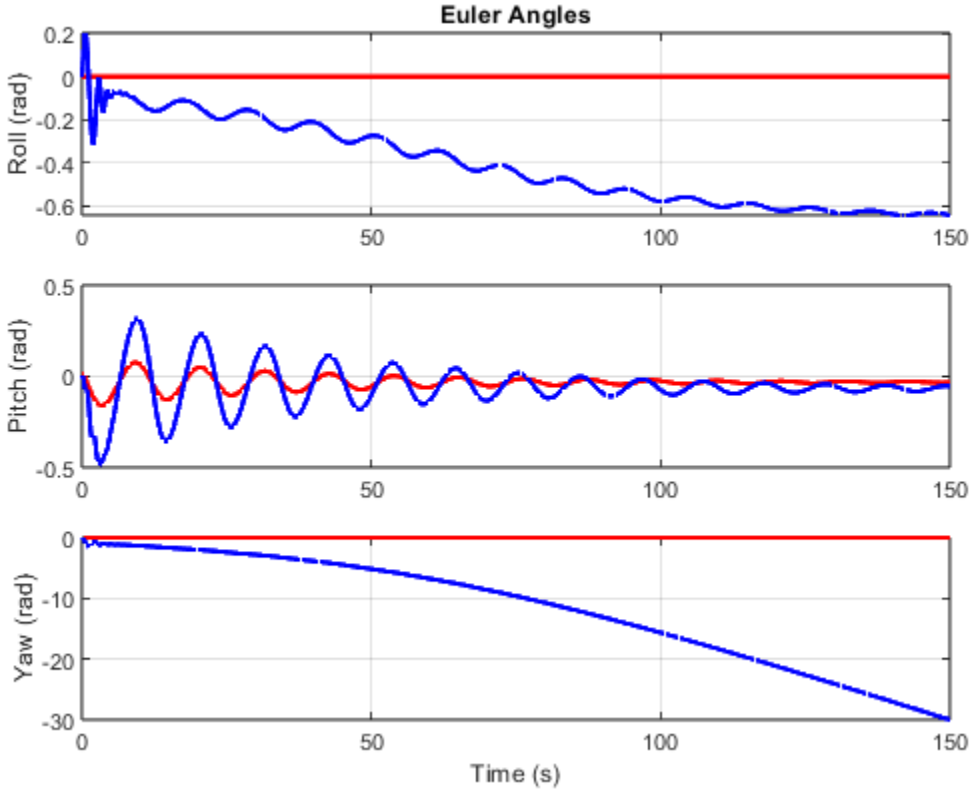

Control Inputs
Elevator (rad)
Aileron (rad)
Rudder (rad)
Throttle (frac)
1
0
-1
0
50
100
150
Time (s)

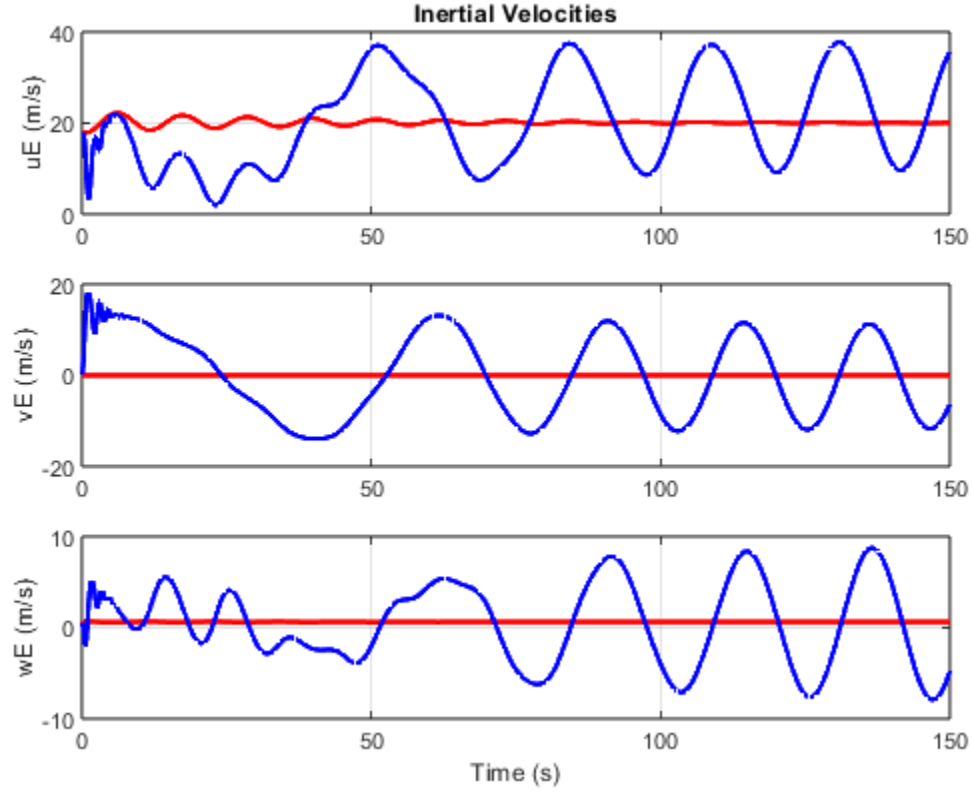

Aircraft Path
Z Position (m)
1700
1650
1600
1550
1500
1450
Y Position (m)
1
0.5
0
-0.5
-1
X Position (m)
0
1000
2000
3000

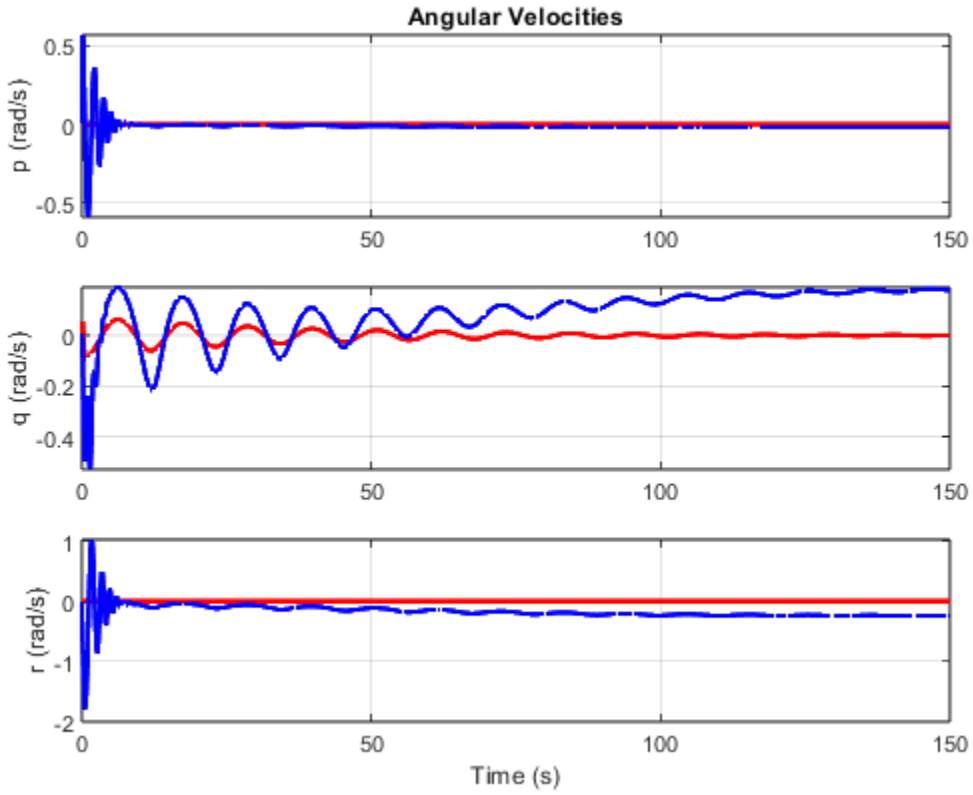
Problem 3.2

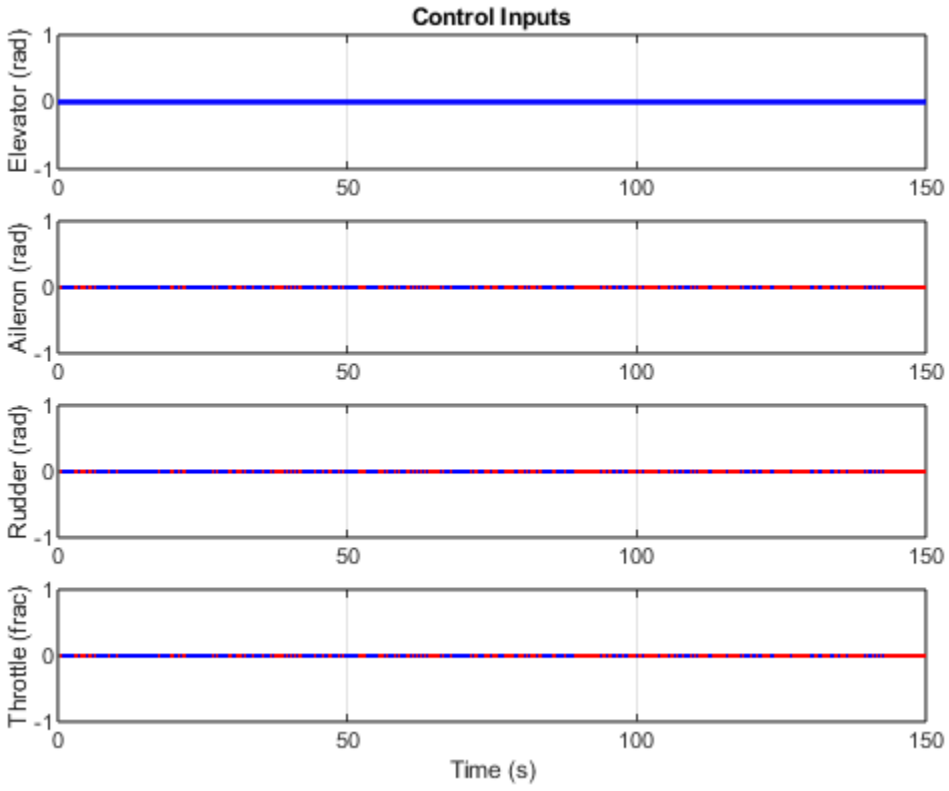
```
V = WindAnglesToAirRelativeVelocityVector([18; 0; 0]);
wind_inertial = [10; 10; 0];
VE = TransformFromBodyToInertial(V, [0; 0; 0]);
h = 1655;
init_state = [0; 0; -h; 0; 0; 0; VE(1); VE(2); VE(3); 0; 0; 0];
aircraft_surfaces = [0; 0; 0; 0];

odeFunc = @(time, aircraft_state)AircraftEOM_key(time, aircraft_state,
aircraft_surfaces, wind_inertial, aircraft_parameters);
[Tout, Xout] = ode45(odeFunc, tspan, init_state);

Uout = zeros(length(Tout),4);
for i=1:length(Tout)
    Uout(i,:) = aircraft_surfaces';
end

PlotSimulation(Tout, Xout, Uout, 1:6, ['b', '-']);
```

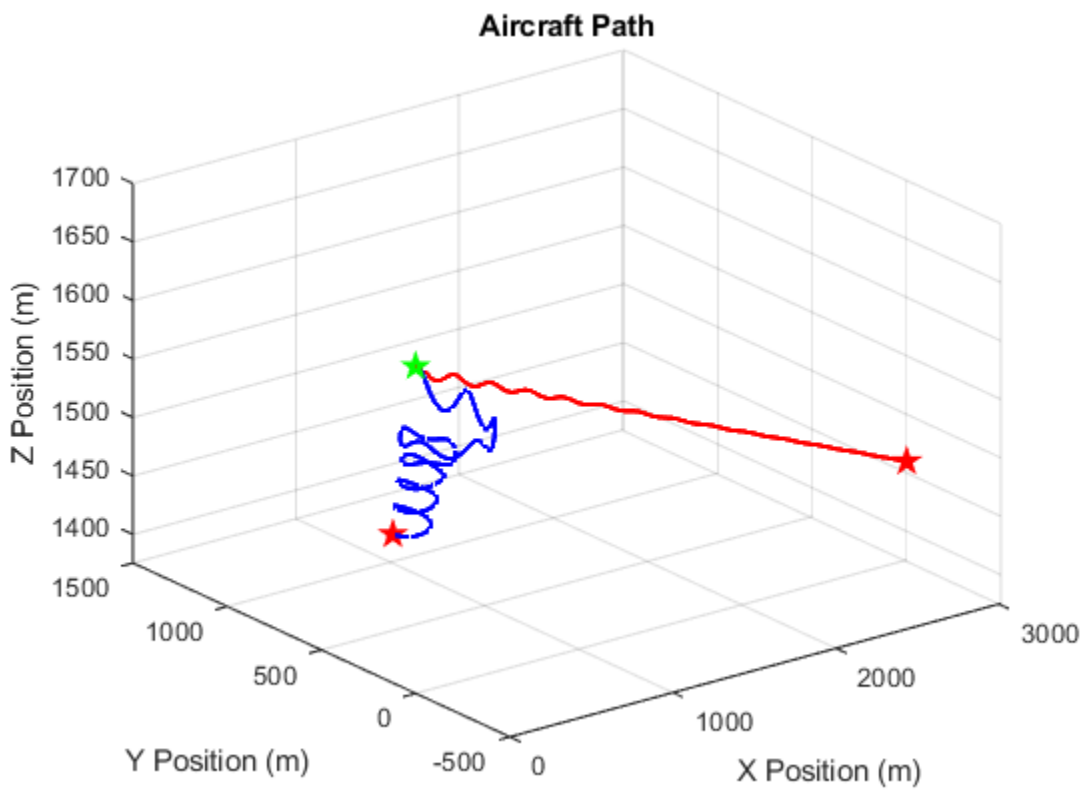



Euler Angles
Roll (rad)
Pitch (rad)
Yaw (rad)
Time (s)


Inertial Velocities
uE (m/s)
vE (m/s)
wE (m/s)
Time (s)

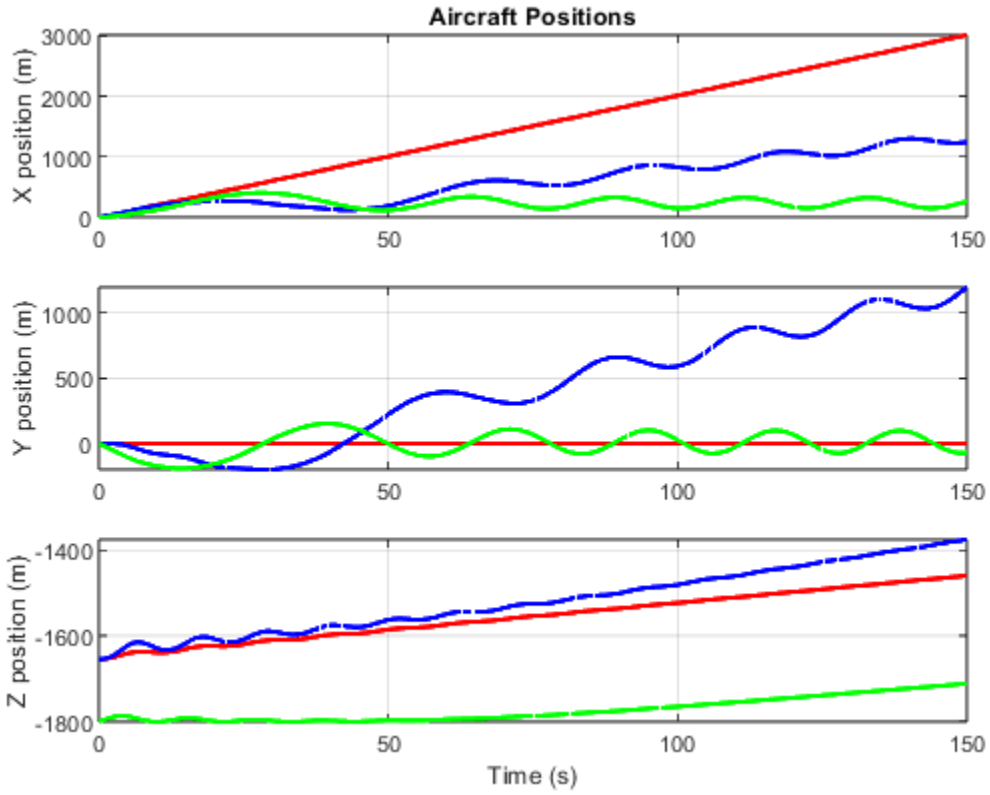

Angular Velocities
p (rad/s)
q (rad/s)
r (rad/s)
Time (s)

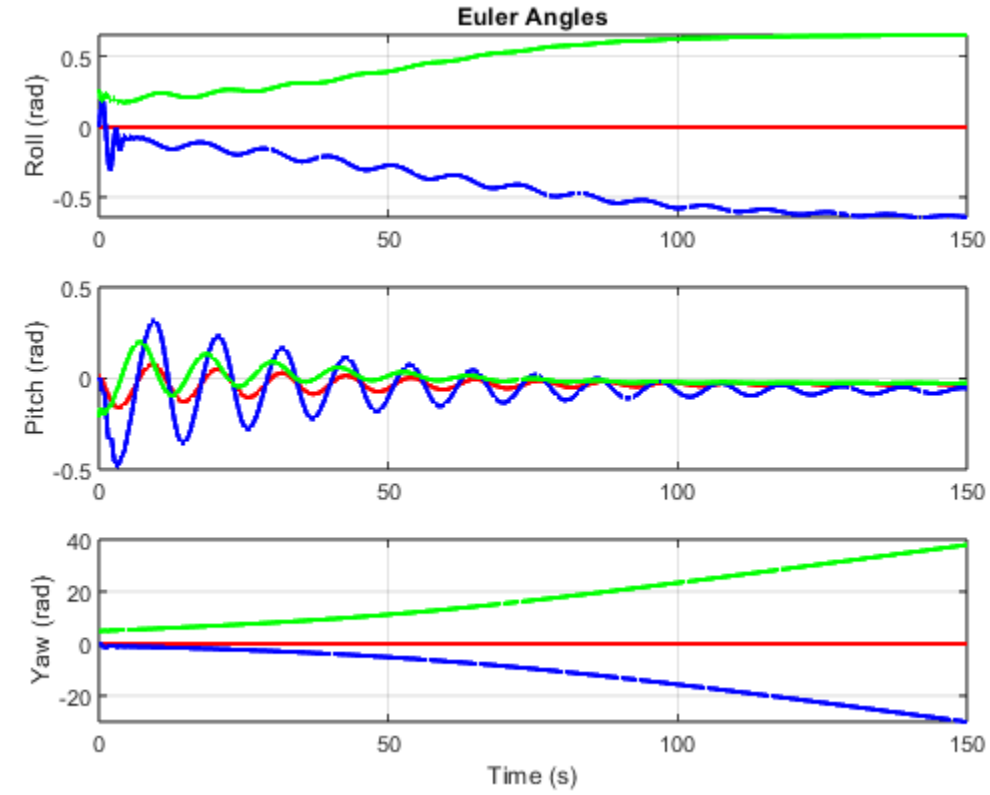

Control Inputs
Elevator (rad)
Aileron (rad)
Rudder (rad)
Throttle (frac)
Time (s)

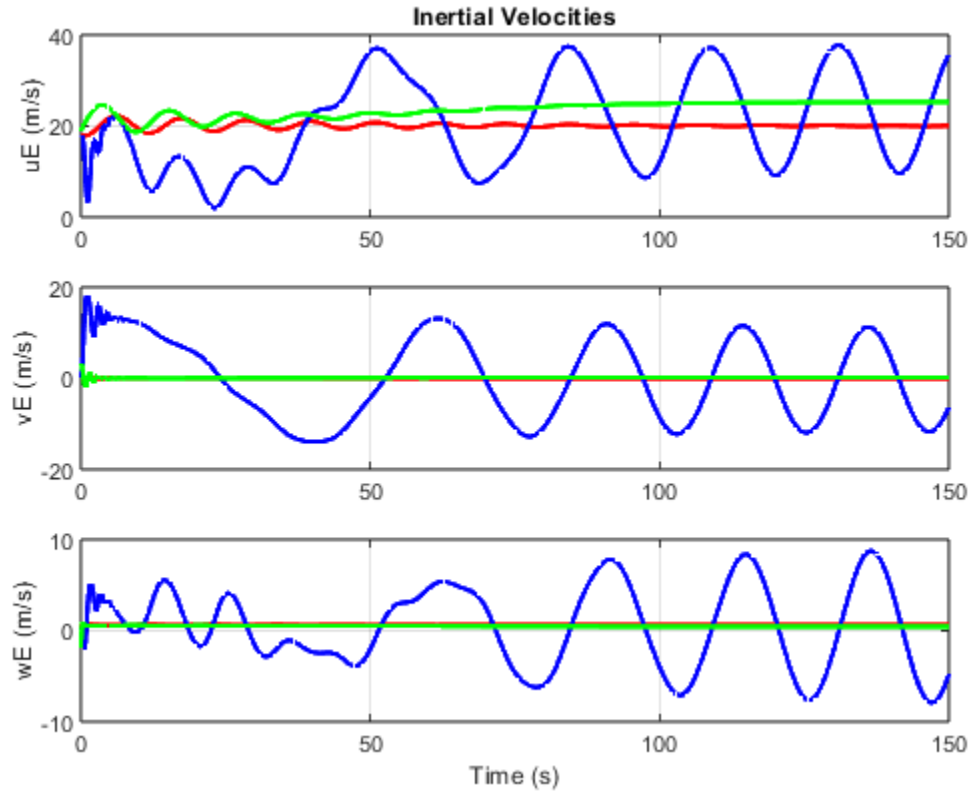


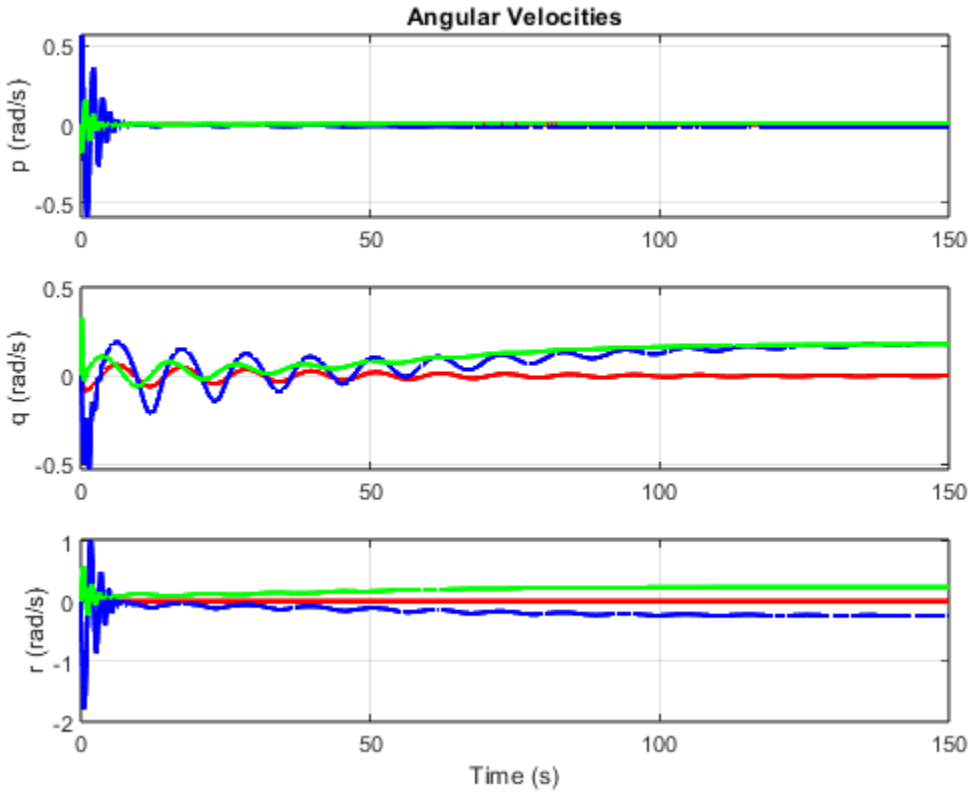
Problem 3.3

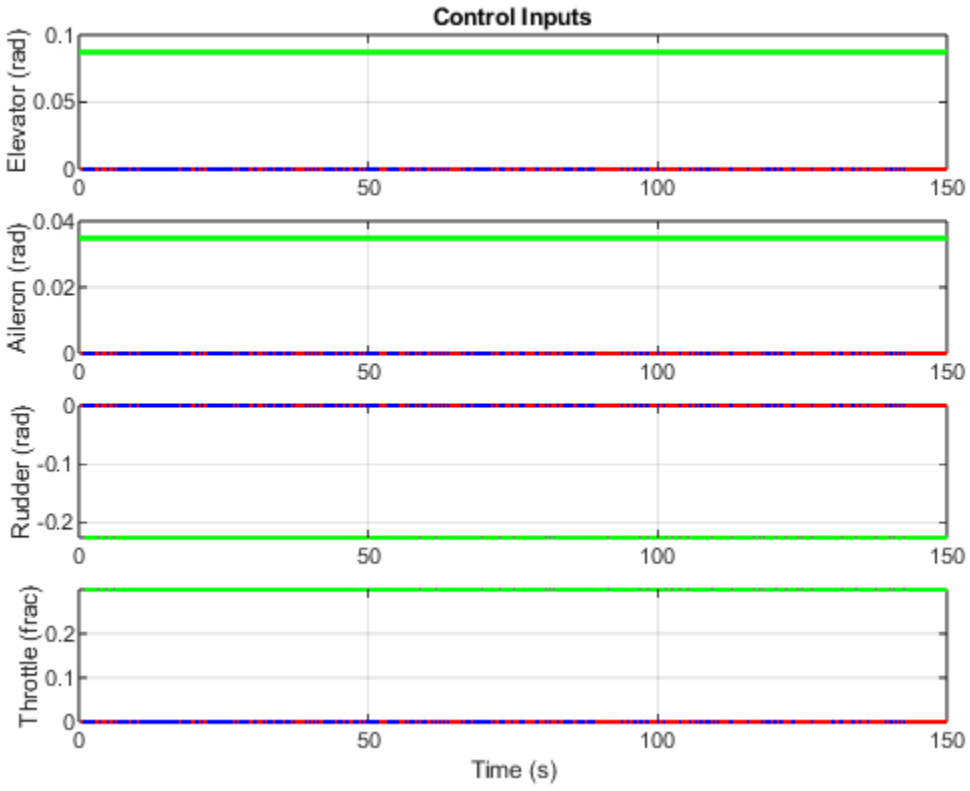
```
h = 1800;
init_state = [0; 0; -h; 15*pi/180; -12*pi/180; 270*pi/180; 19; 3; -2;
0.08*pi/180; -0.2*pi/180; 0];
aircraft_surfaces = [5*pi/180; 2*pi/180; -13*pi/180; 0.3];
wind_inertial = [0;0;0];
rho = stdatmo(h);

odeFunc = @(time, aircraft_state)AircraftEOM(time, aircraft_state,
aircraft_surfaces, wind_inertial, aircraft_parameters);
[Tout, Xout] = ode45(odeFunc, tspan, init_state);

Uout = zeros(length(Tout),4);
for i=1:length(Tout)
    Uout(i,:) = aircraft_surfaces';
end

PlotSimulation(Tout, Xout, Uout, 1:6, ['g', '-']);
```

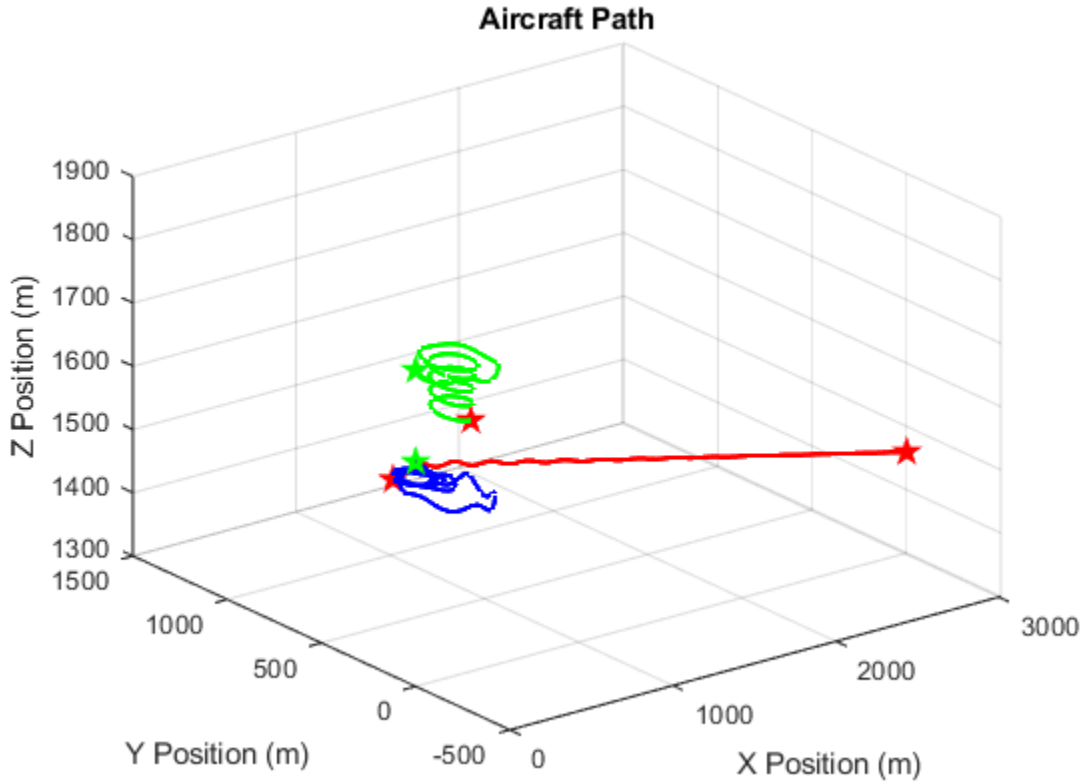

Aircraft Positions
X position (m)
3000
2000
1000
0
Y position (m)
1000
500
0
Z position (m)
-1400
-1600
-1800
0
50
100
150
Time (s)


Euler Angles
Roll (rad)
0.5
0
-0.5
Pitch (rad)
0.5
0
-0.5
Yaw (rad)
40
20
0
-20
0
50
100
150
Time (s)


Inertial Velocities
uE (m/s)
vE (m/s)
wE (m/s)
Time (s)


Angular Velocities
p (rad/s)
q (rad/s)
r (rad/s)
Time (s)


Control Inputs
Elevator (rad)
0.1
0.05
0
Aileron (rad)
0.04
0.02
0
Rudder (rad)
0
-0.1
-0.2
Throttle (frac)
0.2
0.1
0
0
50
100
150
Time (s)


Aircraft Path
Z Position (m)
1900
1800
1700
1600
1500
1400
1300
1500
1000
500
0
-500
Y Position (m)
0
1000
2000
3000
X Position (m)

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