

Full Sim Experiment - Nominal

```
motorRes = [.4 .4 .4 .4];  
tic  
sim('MavicProComplete_oct22');
```

```
Found algebraic loop containing:  
MavicProComplete_oct22/Quadcopter/Powertrain/motorGroup/BLDC Motor4/throttle_fcn/Product2 (algebraic variable)  
MavicProComplete_oct22/Quadcopter/Powertrain/motorGroup/BLDC Motor4/throttle_fcn/Product  
MavicProComplete_oct22/Quadcopter/Powertrain/motorGroup/BLDC Motor4/Sum1  
MavicProComplete_oct22/Quadcopter/Powertrain/motorGroup/BLDC Motor4/Divide1  
MavicProComplete_oct22/Quadcopter/Powertrain/motorGroup/BLDC Motor3/throttle_fcn/Product2  
MavicProComplete_oct22/Quadcopter/Powertrain/motorGroup/BLDC Motor3/throttle_fcn/Product  
MavicProComplete_oct22/Quadcopter/Powertrain/motorGroup/BLDC Motor3/Sum1  
MavicProComplete_oct22/Quadcopter/Powertrain/motorGroup/BLDC Motor3/Divide1  
MavicProComplete_oct22/Quadcopter/Powertrain/motorGroup/BLDC Motor2/throttle_fcn/Product2  
MavicProComplete_oct22/Quadcopter/Powertrain/motorGroup/BLDC Motor2/throttle_fcn/Product  
MavicProComplete_oct22/Quadcopter/Powertrain/motorGroup/BLDC Motor2/Sum1  
MavicProComplete_oct22/Quadcopter/Powertrain/motorGroup/BLDC Motor2/Divide1  
MavicProComplete_oct22/Quadcopter/Powertrain/motorGroup/Switch (discontinuity)  
MavicProComplete_oct22/Quadcopter/Powertrain/BuckConverter/Product  
MavicProComplete_oct22/Quadcopter/Powertrain/motorGroup/Divide  
MavicProComplete_oct22/Quadcopter/Powertrain/motorGroup/Product (algebraic variable)  
MavicProComplete_oct22/Quadcopter/Powertrain/motorGroup/BLDC Motor1/throttle_fcn/Product2  
MavicProComplete_oct22/Quadcopter/Powertrain/motorGroup/BLDC Motor1/throttle_fcn/Product  
MavicProComplete_oct22/Quadcopter/Powertrain/motorGroup/BLDC Motor1/Sum1  
MavicProComplete_oct22/Quadcopter/Powertrain/motorGroup/BLDC Motor1/Divide1  
MavicProComplete_oct22/Quadcopter/Powertrain/motorGroup/Sum (algebraic variable)
```

```
toc
```

Elapsed time is 108.915130 seconds.

```
disp("mission took: " + num2str(tout(end)) + "seconds");
```

mission took: 501.4408seconds

```
disp("rpm residual: " + num2str(mean(rpm_res/100)));
```

rpm residual: 0.24276

```
disp("cur residual: " + num2str(mean(i_res)));
```

cur residual: -0.02031

```
disp("final position: " + num2str(round(pos(end,1),1)) + "," + num2str(round(pos(end,2),1)));
```

final position: 0.1,2415.5

```
disp("soc: " + num2str(soc.Data(end)));
```

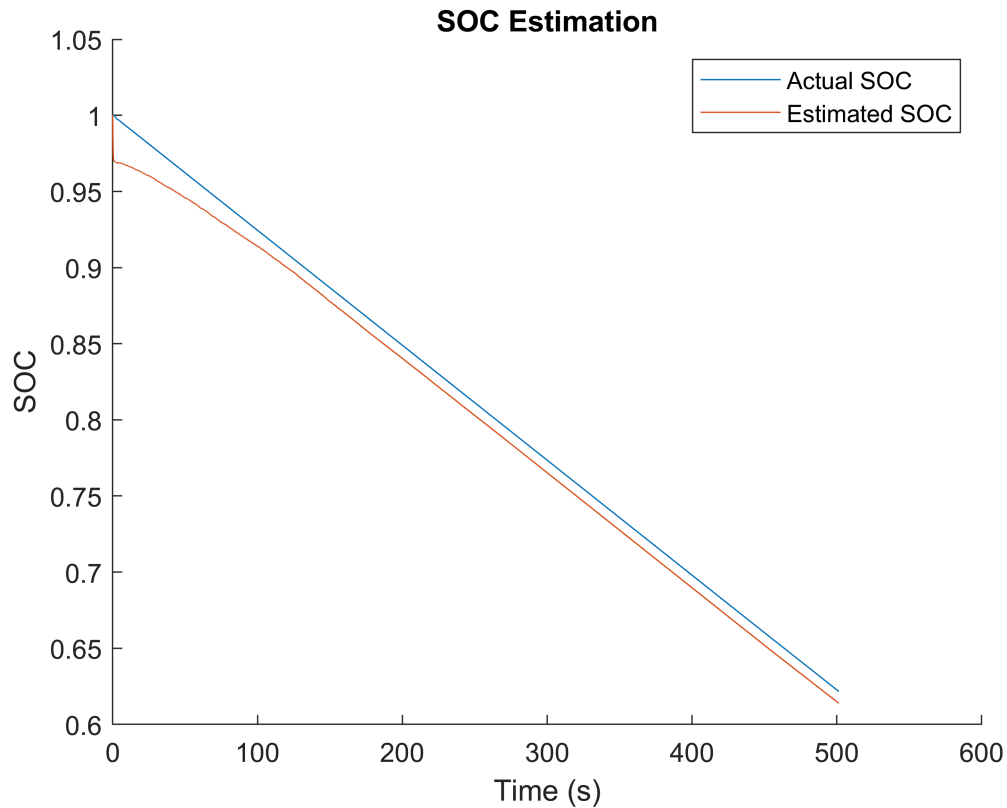
soc: 0.62163

```
f1 = figure(1); clf;  
hold on;  
plot(soc.Time, soc.Data);
```

```

plot(soc_hat.Time, soc_hat.Data);
title("SOC Estimation");
legend(["Actual SOC", "Estimated SOC"]);
ylabel("SOC");
xlabel("Time (s)");
hold off;

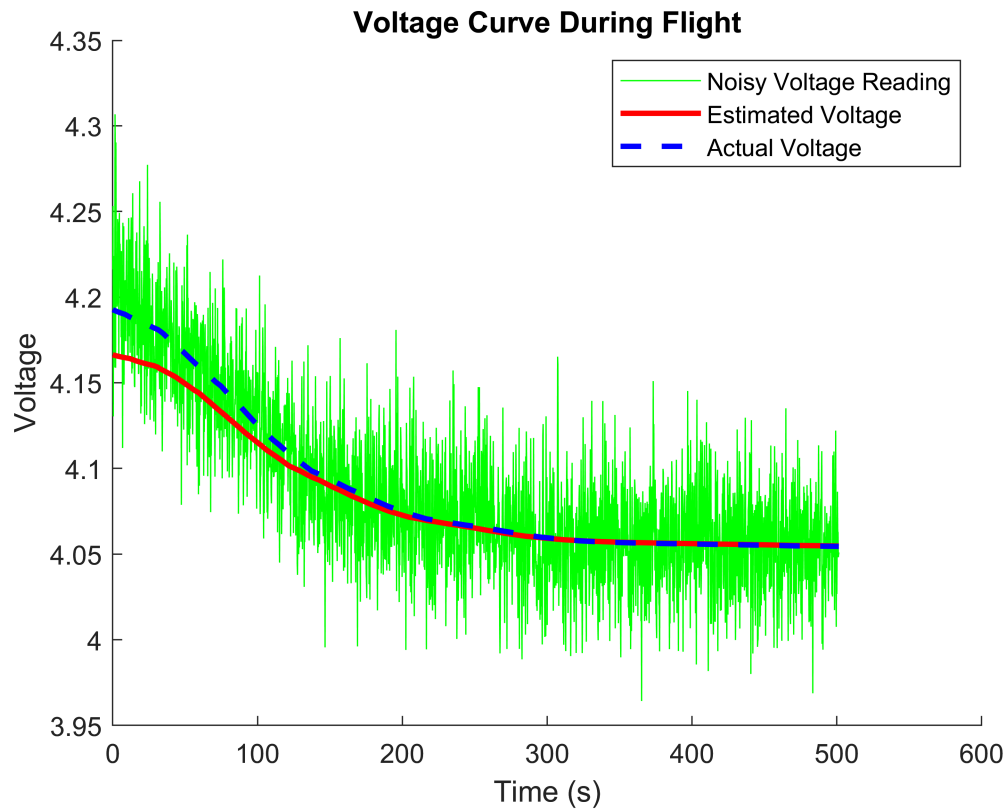
```



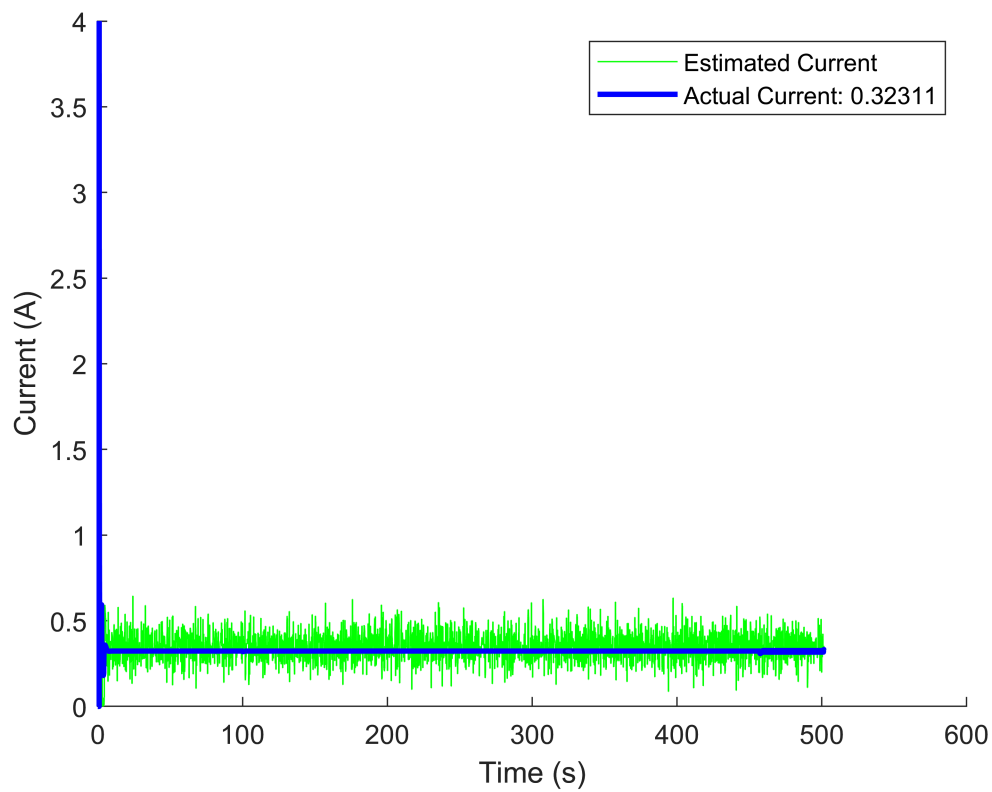
```

f2 = figure(2); clf;
hold on;
plot(noisy_v.Time, noisy_v.Data, 'g');
plot(v_batt_hat.Time, smoothdata(v_batt_hat.Data, 'movmean', 500), 'r', 'linewidth', 2);
plot(v_batt.Time, smoothdata(v_batt.Data, 'movmean', 500), 'b--', 'linewidth', 2);
hold off;
title("Voltage Curve During Flight");
xlabel("Time (s)");
ylabel("Voltage");
legend(["Noisy Voltage Reading", "Estimated Voltage", "Actual Voltage"]);

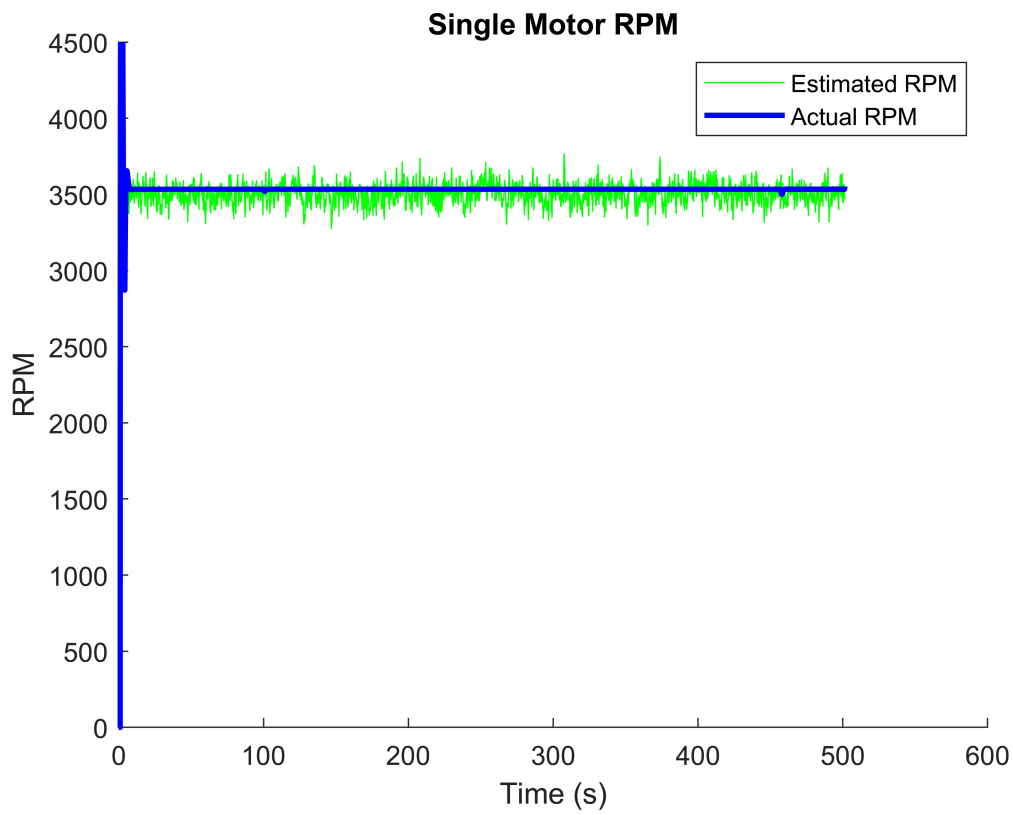
```



```
i_hatData = i_hat.Data(1,:);
f3 = figure(3); clf;
hold on;
plot(i_hat.Time, i_hatData, 'g');
plot(i_mot.Time, i_mot.Data, 'b', 'linewidth', 2);
hold off;
% title("Single Motor Current Draw");
xlabel("Time (s)");
ylabel("Current (A)");
legend(["Estimated Current", "Actual Current: " + num2str(i_mot.Data(1000))]);
ylim([0 4]);
```

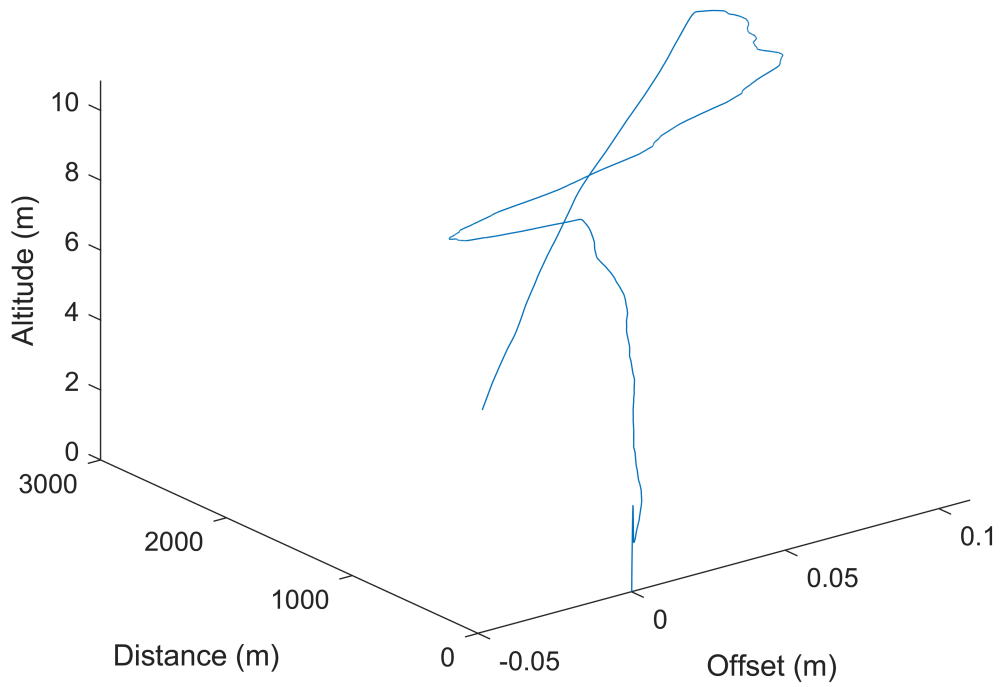


```
f4 = figure(4); clf;
hold on;
plot(rpm_hat.Time, rpm_hat.Data, 'g');
plot(rpm.Time, rpm.Data, 'b', 'linewidth', 2);
hold off;
xlabel("Time (s)");
ylabel("RPM");
ylim([0 4500]);
title("Single Motor RPM");
legend(["Estimated RPM", "Actual RPM"]);
```

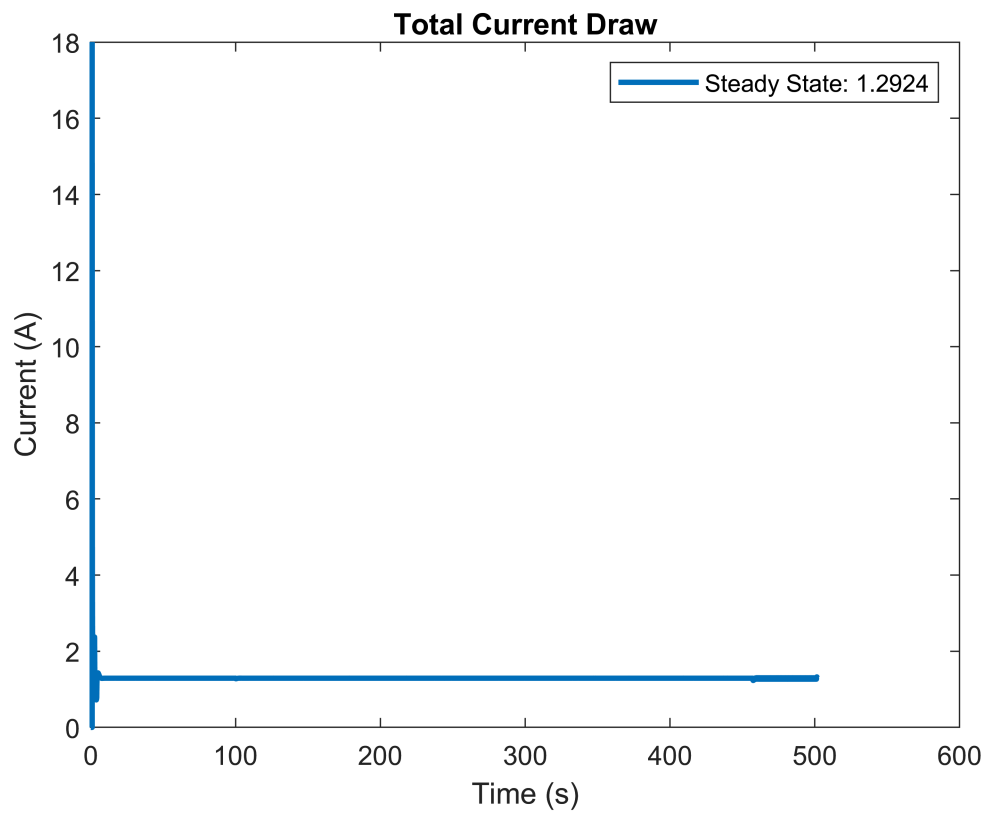


```
f5 = figure(5); clf;  
plot3(pos(:,1), pos(:,2), pos(:,3));  
%xlim([-1 1]);  
xlabel("Offset (m)");  
ylabel("Distance (m)");  
zlabel("Altitude (m)");  
title("UAV Trajectory");
```

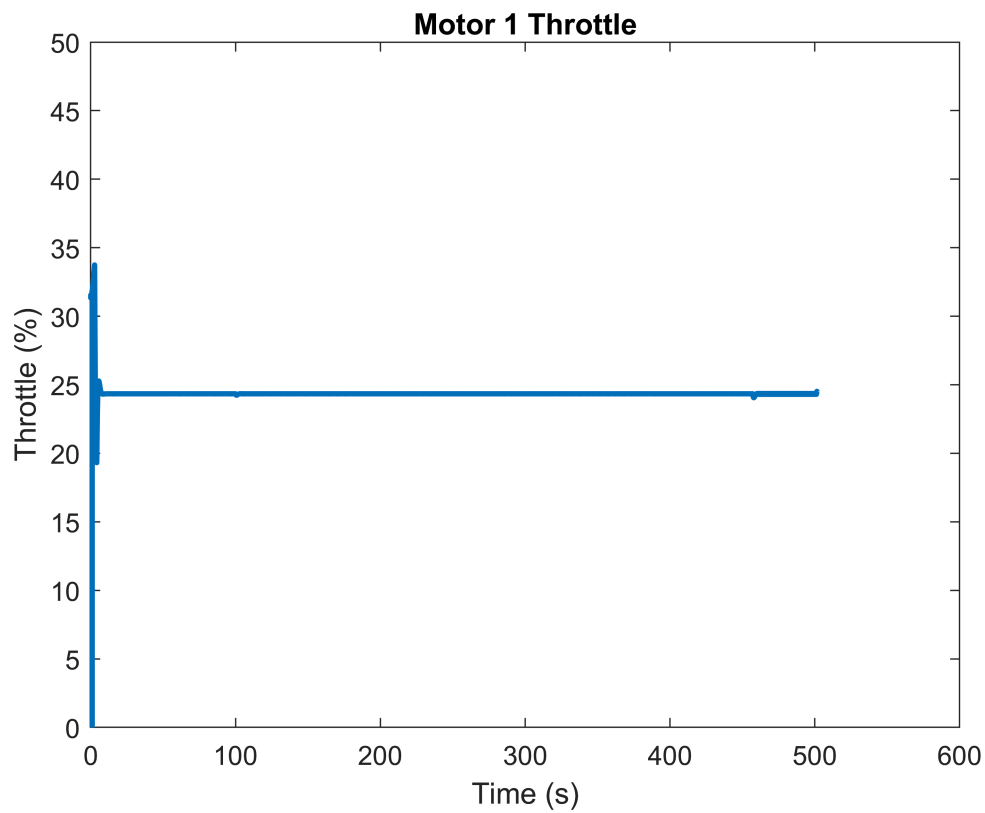
UAV Trajectory



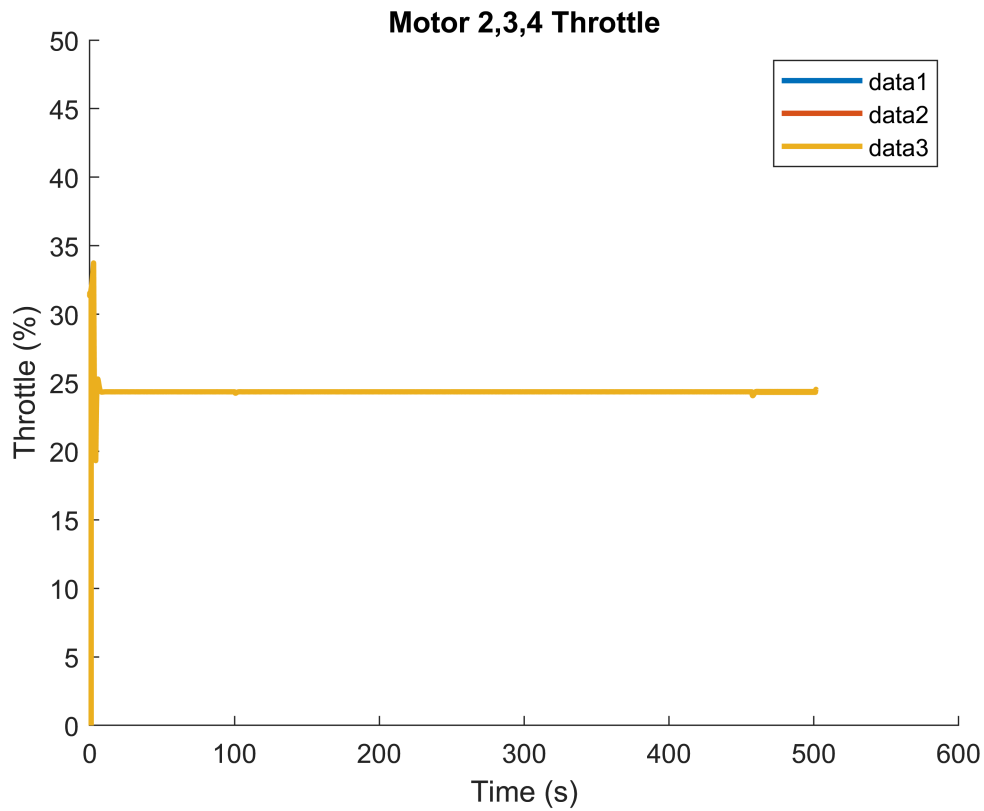
```
f6 = figure(6); clf;
plot(i_batt.Time, i_batt.Data, 'linewidth', 2);
title("Total Current Draw");
xlabel("Time (s)");
ylim([0 18]);
ylabel("Current (A)");
legend(["Steady State: " + num2str(i_batt.Data(1000))]);
```



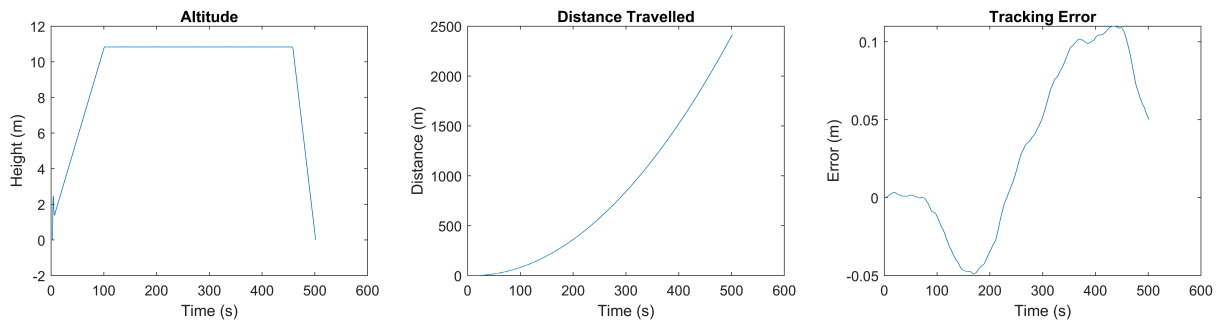
```
f7 = figure(7); clf;  
plot(m1_throttle.Time, m1_throttle.Data, 'linewidth', 2);  
title("Motor 1 Throttle");  
xlabel("Time (s)");  
ylabel("Throttle (%)");  
ylim([0 50]);
```



```
f8 = figure(8); clf;  
hold on;  
plot(m2_throttle.Time, m2_throttle.Data, 'linewidth', 2);  
plot(m3_throttle.Time, m3_throttle.Data, 'linewidth', 2);  
plot(m4_throttle.Time, m4_throttle.Data, 'linewidth', 2);  
hold off;  
title("Motor 2,3,4 Throttle");  
xlabel("Time (s)");  
ylabel("Throttle (%)");  
ylim([0 50]);  
legend()
```

```
f9 = figure(9); clf;
f9.Position = [0 0 1400 300];
subplot(131);
plot(tout, pos(:,3));
title("Altitude");
xlabel("Time (s)");
ylabel("Height (m)");
subplot(132);
plot(tout, pos(:,2));
title("Distance Travelled");
xlabel("Time (s)");
ylabel("Distance (m)");
subplot(133);
plot(tout, pos(:,1));
title("Tracking Error");
xlabel("Time (s)");
ylabel("Error (m)");
```



```
f10 = figure(10); clf;
plot(power.Time, power.Data, 'line', 2);
title("Power Consumption During Flight");
xlabel("Time (s)");
ylabel("Power Consumption (w)");
ylim([0 50]);
```

