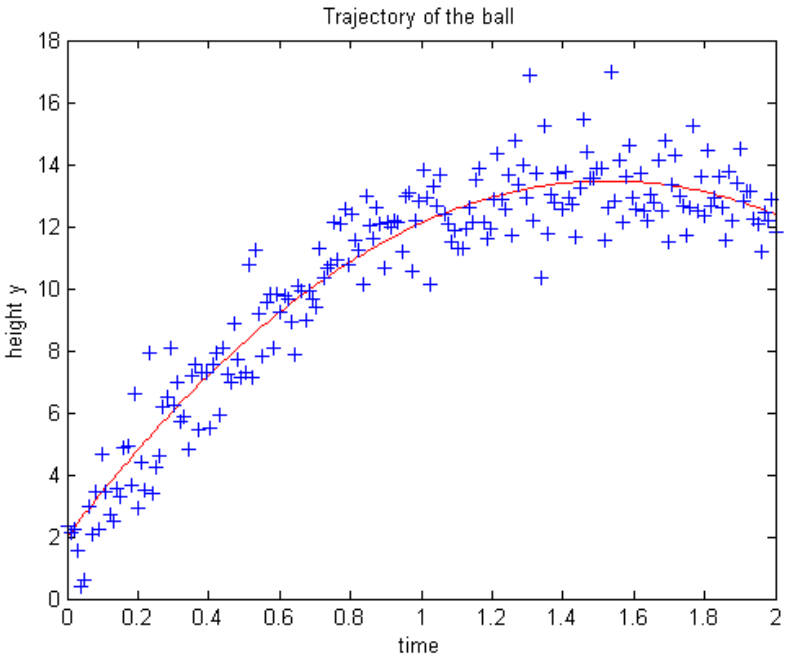
Contents


```
% Andrew Gerst

clear all; close all;
```

Part 1.1 - Simulating A Trajectory

```
g = 9.81;
v_0 = 15;
h_0 = 2;
t = linspace(0,2,200);
plot(t,-(g/2) * t .^ 2 + v_0 * t + h_0,'r');
title('Trajectory of the ball');
xlabel('time');
ylabel('height y');

% Plot Individual Trajectories
load noisyTrajectory
hold on
plot(t,yn,'+b');
```

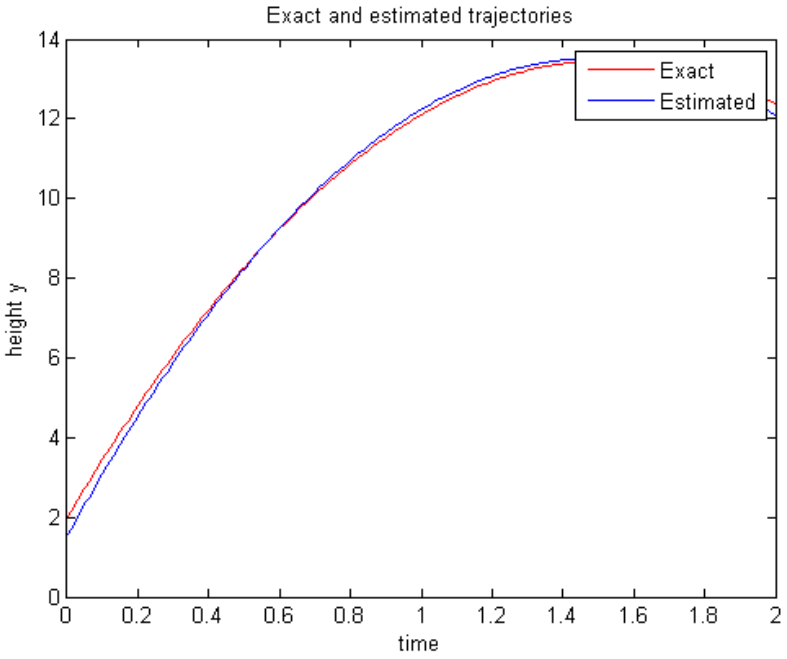


Part 1.2 - Estimating the parameters from a noisy trajectory

```
% Estimate Parameters
A = [ones(size(yn)) t' t' .^ 2];
est = A\yn
est_g = abs(est(3)*2);
est_v_0 = est(2);
est_h_0 = est(1);

% Estimated Trajectory
hold off
plot(t,-(g/2) * t .^ 2 + v_0 * t + h_0,'r');
hold on
plot(t,-(est_g/2) * t .^ 2 + est_v_0 * t + est_h_0,'b');
legend('Exact','Estimated');
title('Exact and estimated trajectories');
```

```
xlabel('time');
ylabel('height y');

% Compute the Sum of Squared Differences
ssdiff_exact = sum((yn' - (-(g/2) * t .^ 2 + v_0 * t + h_0)) .^ 2);
ssdiff_est = sum((yn' - (-(est_g/2) * t .^ 2 + est_v_0 * t + est_h_0)) .^ 2);
ssdiff_exact
ssdiff_est
if ssdiff_est < ssdiff_exact
    disp('The estimated difference is smaller because the estimated model is based on the data we are comparing
 it to.');
end
```

```
est =

    1.5429
   16.1004
   -5.4128


ssdiff_exact =

  237.6506


ssdiff_est =

  232.2389

The estimated difference is smaller because the estimated model is based on the data we are comparing it to.
```



Part 1.3 - Identify the planet

```
load planetData
planets = {'Saturn','Moon','Earth','Pluto','Sun','Mercury','Mars','Jupiter'};
planets_g = [11.2 1.63 9.81 0.61 274.1 3.7 3.73 25.9];
planets_abbr = {'st','nd','rd','th','th','th','th','th'};
for i = 1:8
    planet = A\yAN(:,i);
    planet_g = abs(planet(3)*2);
    fprintf('%-7s is the %d%s planet (column) with an estimated (observed) gravity of %7.3f and actual gravity
of %6.2f\n',...
        planets{i},i,planets_abbr{i},planet_g,planets_g(i));
end
```

```
% Saturn 1, Moon 2, Earth 3, Pluto 4, Sun 5, Mercury 6, Mars 7, Jupiter 8
```

```
Saturn  is the 1st planet (column) with an estimated (observed) gravity of  11.096 and actual gravity of  11.20
Moon    is the 2nd planet (column) with an estimated (observed) gravity of   1.625 and actual gravity of   1.63
Earth   is the 3rd planet (column) with an estimated (observed) gravity of   9.897 and actual gravity of   9.81
Pluto   is the 4th planet (column) with an estimated (observed) gravity of   0.547 and actual gravity of   0.61
Sun     is the 5th planet (column) with an estimated (observed) gravity of 274.115 and actual gravity of 274.10
Mercury is the 6th planet (column) with an estimated (observed) gravity of   3.738 and actual gravity of   3.70
Mars    is the 7th planet (column) with an estimated (observed) gravity of   3.739 and actual gravity of   3.73
Jupiter is the 8th planet (column) with an estimated (observed) gravity of  25.791 and actual gravity of  25.90
```

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