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```
% Seth Kelly
% MAE 315 Intro Example Code
% Fall 2021
```

```
% MAKE SURE YOUR DATA FILES AND FUNCTIONS ARE ALL SAVED IN THE SAME
% FOLDER!
```

```
% Prepare Script
clc          % Clear command prompt
close all   % Close any open plot
clear all   % Clear workspace variables
```

```
% In this example, we will use MATLAB to determine the uncertainty
% in the calculation of the density of a particular ingot of Valyrian
% Steel
% Define the functional relationship for the density of the
% cylindrical
% ingot.
```

## Create symbols for mass, diameter, and length to manipulate

```
syms m d l
% mass, diameter, length <-- measurements from lab with known
% resolutions
```

## Define our governing equations for parameters we are looking for:

(In this case --> volume and density)

```
vol = (1/4)*pi*d^2*l; % Volume of a cylinder
rho = m/vol;          % Density
```

---

## Measurement resolutions and uncertainty

```
u_m = 0.2/2;           % mass uncertainty (slug)
u_d = (0.1/12)/2;     % diameter uncertainty (ft)
u_l = (0.01/12)/2;    % length uncertainty (ft)
```

## Zeroth order uncertainty equation

```
u_rho = sqrt((diff(rho,m).*u_m).^2 + (diff(rho,d).*u_d).^2 + ...
             (diff(rho,l).*u_l).^2);
```

## Define our symbolic values (this is where you could import your data)

example population: 13 specimens

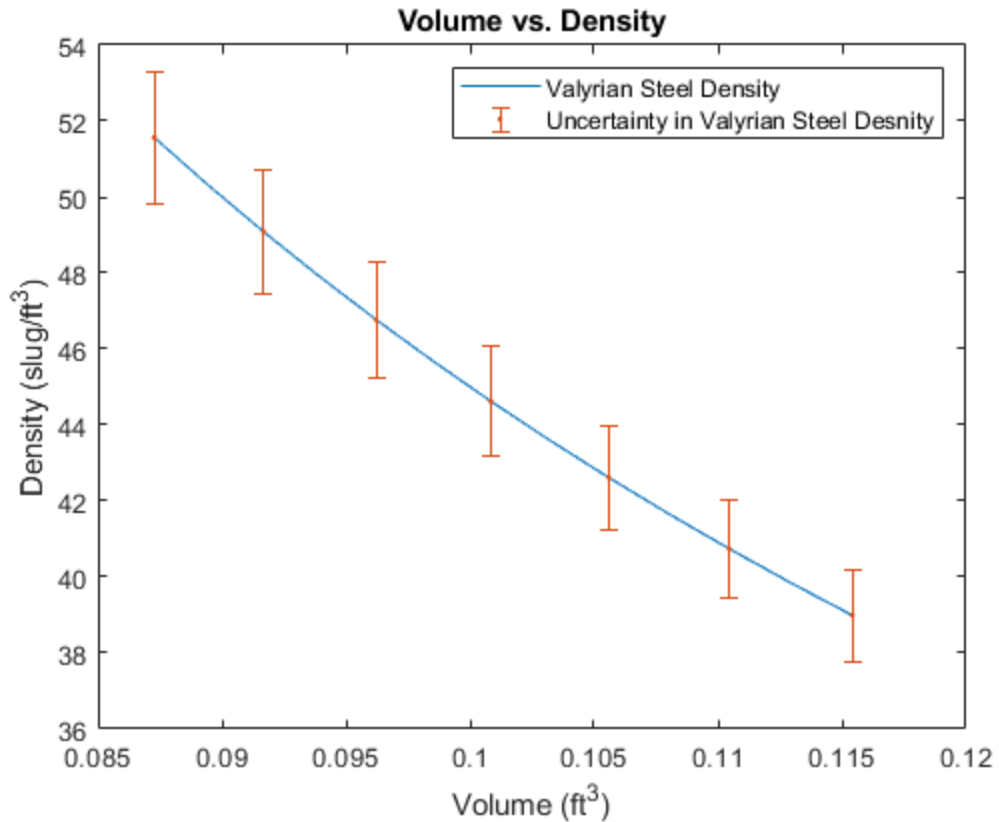
```
m = 4.5;                % mass (slugs)
d = linspace(4.0,4.6,13)./12; % diameter array
l = [6.0:0.05:6.6]./12; % length array (ft)
```

## Substitute values into equations to find parameters and uncertainty

```
rho = eval(rho); % slug/ft^3
u_rho = eval(u_rho); % slug/ft^3
vol = eval(vol); % ft^3
```

## Plot with errorbars

```
figure(1)
plot(vol,rho)
hold on
title('Volume vs. Density')
xlabel('Volume (ft^3)')
ylabel('Density (slug/ft^3)')
errorbar(vol(1:2:end),rho(1:2:end),u_rho(1:2:end),'.') % may need to
space out errorbars
legend('Valyrian Steel Density','Uncertainty in Valyrian Steel
Density')
```



## Importing Data

this is just one of many importing methods (google--> mathworks website) make sure the file is in the same folder

```
raw_data = importdata('Intro_specimen.txt', '\t', 2);
info = raw_data.data; % extracts useable data from dataframe
```

## example using loops

```
i = 1; % initialize i value before using it in while loop
while i <=length(info)
    new_info(i) = info(i,1)*10;
    i = i+1; % increase i by 1 each iteration
end

% for loops can sometimes be more compact
for n=1:length(info)
    new_info2(n)=info(n,1)*10;
end
```

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