MATLAB & Mobile Phone Sensors

Using "MATLAB Mobile" to access organic cell phone sensors and to export data file to "MATLAB Drive."

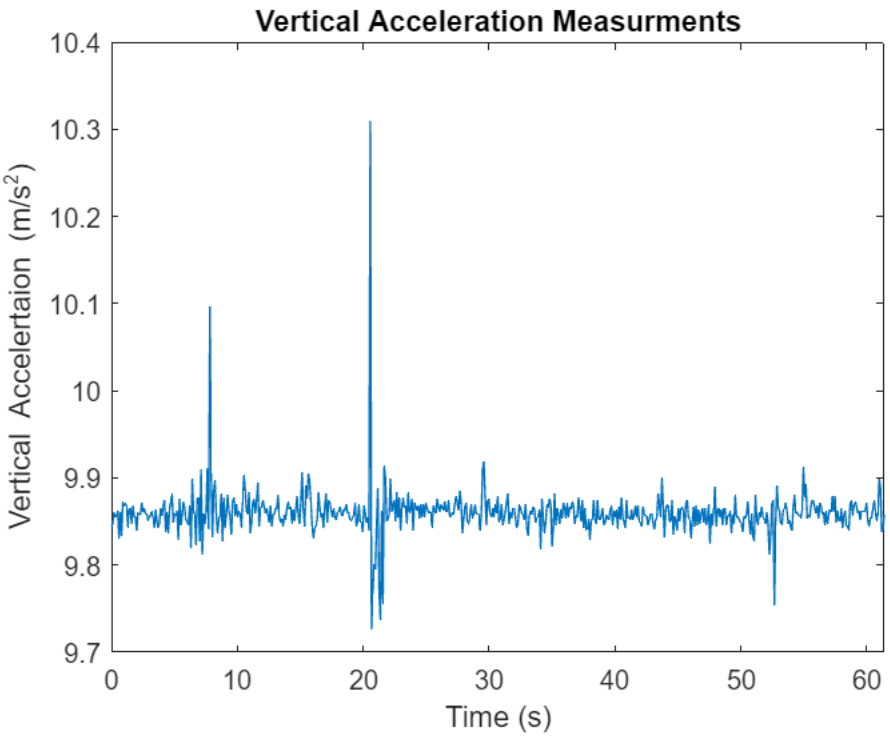
Experiment A: Turn on the acceleration sensor. Place the cell phone flat on the table. Collect data for 1-2 minutes. Download the data file from MATLAB Drive.

Load acceleration data file to workspace

```
load("C:\Users\m260477\Desktop\EW202\ICE\ICE2\Z_Acceleration.mat")
```

Plot vertical acceleration data (Z axis data when the cell phone is placed face-up on table)

```
time = Acceleration.Timestamp; % grab timestamps
x = seconds(cumsum(diff(time))); % calculate the difference between timestamps and
cumulative sum them
x = [0; x]; % time starts at 0 seconds
z = Acceleration.Z; % grab z-axis acceleration
plot(x,z) % plot acceleration vs. time
title("Vertical Acceleration Measurments")
xlabel("Time (s)")
ylabel("Vertical Accelertaion (m/s^2)")
xlim("tight")
```



Find the latest value of the vertical acceleration

```
z(end)
```

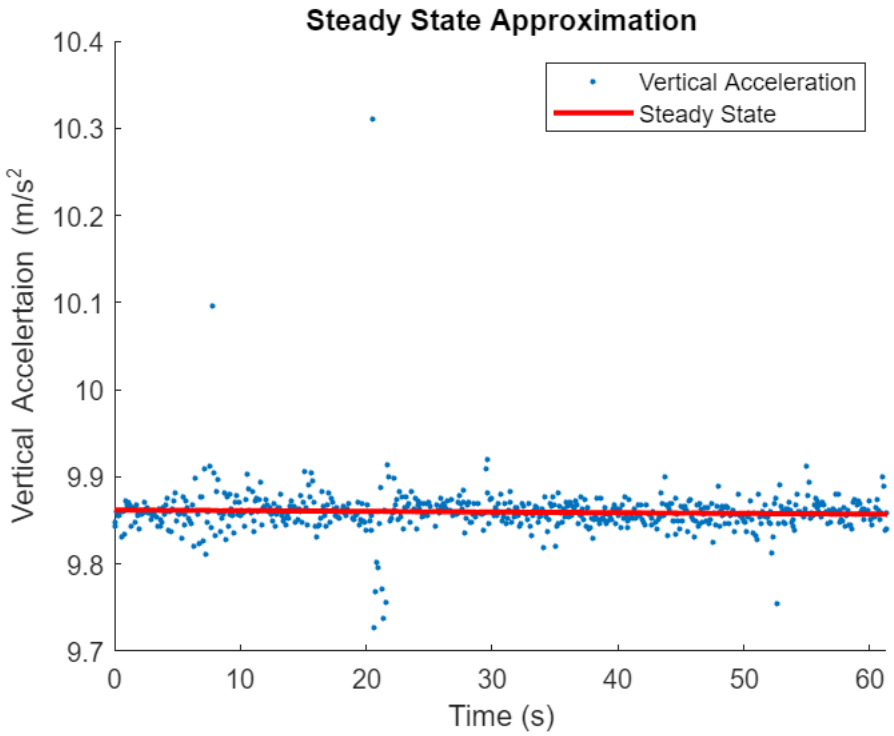
```
ans = 9.8582
```

Is this value a good estimate of the steady state?

Not really... Its just the last value. Doesn't represent the whole sample data collected.

Find a better estimate of the steady-state value

```
scatter(x,z,".") % scatter plot acceleration vs. time
pfit = polyfit(x,z,1); % fit line to data
pval = polyval(pfit,x); % evaulate fitted line
hold on
plot(x,pval,"r","LineWidth",2) % plot fitted line
title("Steady State Approximation")
legend(["Vertical Acceleration" "Steady State"])
xlabel("Time (s)")
ylabel("Vertical Accelertaion (m/s^2")
xlim("tight"),
hold off
```




```
trimmed_mean_estimate = trimmean(z,10) % grab 10% trimmed mean
```

```
trimmed_mean_estimate = 9.8591
```

What is the value of the acceleration of gravity?

9.81

Write a logical IF statement to declare (or not) error in the measurement of g=9.81 m/s^2:

```
if trimmed_mean_estimate ~= 9.81 % check if estimate is equal to 9.81
    disp('There is measurement error')
else
    disp('There is no measurement error')
end
```

```
There is measurement error
```

How is acceleration measured in general? What type of accelerometer is inside the cell phone?

Accleration is the change in velocity with resepect to time.

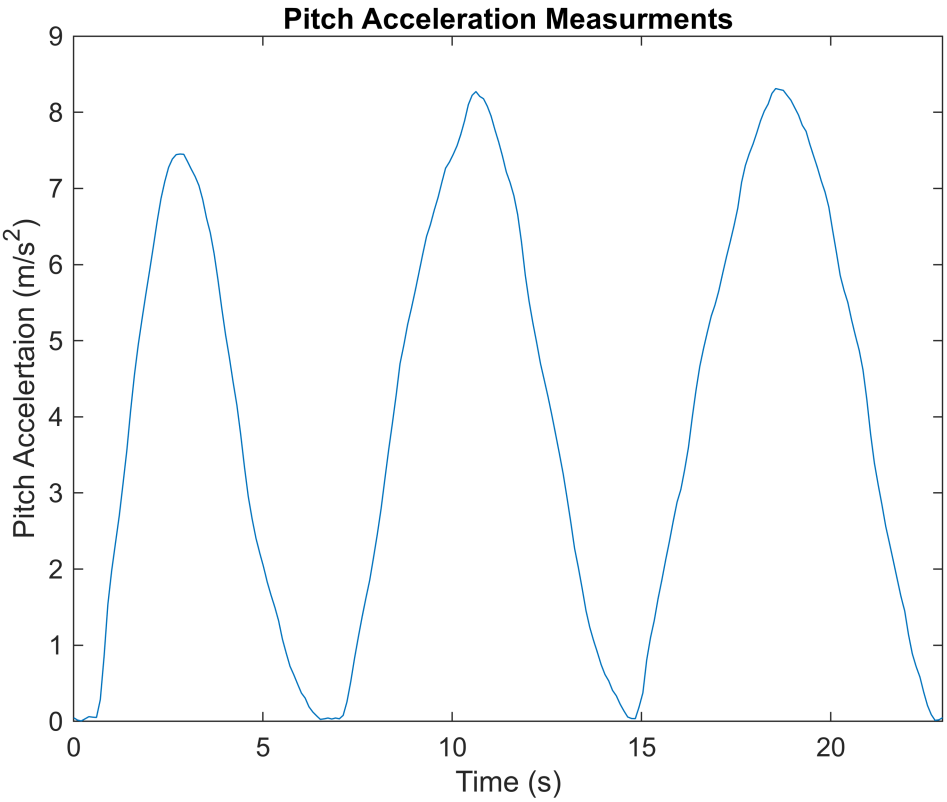
MEMS-based accelerometer.

[STRETCH] Experiment B: Generate orientation data (e.g., change the pitch anlge, that is, the angle from the table to the plane of the phone). Load orientation data file to workspace

```
load("C:\Users\m260477\Desktop\EW202\ICE\ICE2\Y_Acceleration.mat")
```

Plot orientation data

```
time = Acceleration.Timestamp; % grab timestamps
x = seconds(cumsum(diff(time))); % calculate the difference between timestamps and
cumulative sum them
x = [0; x]; % time starts at 0 seconds
y = Acceleration.Y; % grab z-axis acceleration
plot(x,y) % plot acceleration vs. time
title("Pitch Acceleration Measurments")
xlabel("Time (s)")
ylabel("Pitch Accelertaion (m/s^2)")
xlim("tight")
```



Does the graph capture the pitch angle correctly?

Yes!

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