Contents

```matlab
% -----------
% rocket filters and plot
% -----------
% This script filters the raw position data from 5 different rockets
% (see below) for 2 different tests (slow and fast) using a low pass
% filter.  The resulting filtered position data is then differentiated to
% obtain smoothed velocity and acceleration data.
% The filter desig (slow and fast) based on visual inspection of the FFT
% and filtered tracees of the 10 different position data sets.
%
% ROCKETS
% -------
% A = dense rubber
% B = long light rubber
% C = plastic
% D = propeller
% E = short light rubber
%
% SCALING AND DIMENSIONS
% ---------------------
% rocket position: pixels versus time
% video/sampling rate: 6250 frames/second
% pixels to dimension calibration: 47.0027 pixels/inch

clear; close all;

fast_denserubber =load('.\data4rocket\fast_denserubber.txt');
slow_denserubber =load('.\data4rocket\slow_denserubber.txt');
%
fast_longliterubber =load('.\data4rocket\fast_longliterubber.txt');
slow_longliterubber =load('.\data4rocket\slow_longliterubber.txt');
%
fast_plastic =load('.\data4rocket\fast_plastic.txt');
slow_plastic =load('.\data4rocket\slow_plastic.txt');
%
fast_proptip =load('.\data4rocket\fast_proptip.txt');
slow_proptip =load('.\data4rocket\slow_proptip.txt');
%
```

```matlab
fast_shortliterubber =load('.\data4rocket\fast_shortliterubber.txt');
slow_shortliterubber =load('.\data4rocket\slow_shortliterubber.txt');
```

position data from file

```matlab
p_fastA_0 = fast_denserubber;
p_slowA_0 = slow_denserubber;
p_fastB_0 = fast_longliterubber;
p_slowB_0 = slow_longliterubber;
p_fastC_0 = fast_plastic;
p_slowC_0 = slow_plastic;
p_fastD_0 = fast_proptip;
p_slowD_0 = slow_proptip;
p_fastE_0 = fast_shortliterubber;
p_slowE_0 = slow_shortliterubber;
```

length of smoothing filter

```matlab
lenfilter = 21;
% a delta function kernel
krnl_delta = zeros(1,lenfilter);
krnl_delta(floor(lenfilter/2)+1) = 1;
% a smoothing kernel
krnl_smooth = hanning(lenfilter);
krnl_smooth = krnl_smooth/sum(krnl_smooth);
```

trim length of position of (unfiltered) posiotion data

so that is same length as fitlered version

```matlab
p_fastA = p_fastA_0;
p_slowA = p_slowA_0;
p_fastB = p_fastB_0;
p_slowB = p_slowB_0;
p_fastC = p_fastC_0;
p_slowC = p_slowC_0;
p_fastD = p_fastD_0;
p_slowD = p_slowD_0;
p_fastE = p_fastE_0;
p_slowE = p_fastE_0;
%
shape = 'valid';
p_fastA = conv(p_fastA,krnl_delta,shape);
p_fastB = conv(p_fastB,krnl_delta,shape);
p_fastC = conv(p_fastC,krnl_delta,shape);
p_fastD = conv(p_fastD,krnl_delta,shape);
p_fastE = conv(p_fastE,krnl_delta,shape);
%
p_slowA = conv(p_slowA,krnl_delta,shape);
p_slowB = conv(p_slowB,krnl_delta,shape);
p_slowC = conv(p_slowC,krnl_delta,shape);
p_slowD = conv(p_slowD,krnl_delta,shape);
p_slowE = conv(p_slowE,krnl_delta,shape);
```

UNFILTERED VELOCITY

```matlab
%derivate kernel
krnl = [1 0 -1]/2;  % could use
v_fastA = conv(p_fastA,krnl,'valid');
```

```
v_slowA = conv(p_slowA,krnl,'valid');
v_fastB = conv(p_fastB,krnl,'valid');
v_slowB = conv(p_slowB,krnl,'valid');
v_fastC = conv(p_fastC,krnl,'valid');
v_slowC = conv(p_slowC,krnl,'valid');
v_fastD = conv(p_fastD,krnl,'valid');
v_slowD = conv(p_slowD,krnl,'valid');
v_fastE = conv(p_fastE,krnl,'valid');
v_slowE = conv(p_slowE,krnl,'valid');
```

UNFILTERED ACCELERATION

```
a_fastA = conv(v_fastA,krnl,'valid');
a_slowA = conv(v_slowA,krnl,'valid');
a_fastB = conv(v_fastB,krnl,'valid');
a_slowB = conv(v_slowB,krnl,'valid');
a_fastC = conv(v_fastC,krnl,'valid');
a_slowC = conv(v_slowC,krnl,'valid');
a_fastD = conv(v_fastD,krnl,'valid');
a_slowD = conv(v_slowD,krnl,'valid');
a_fastE = conv(v_fastE,krnl,'valid');
a_slowE = conv(v_slowE,krnl,'valid');
```

PLOT UNFILTERED POSITION, VELOCITY, AND ACCELERATION TRACES

----

unfiltered fast plot

```
figure(1);
    subplot(3,5,1); hold on; plot(p_fastA);
    title('Position: fastA');
    subplot(3,5,6); hold on; plot(v_fastA);
    title('Velocity: fastA');
    subplot(3,5,11); hold on; plot(a_fastA);
    title('Acceleration: fastA');

    subplot(3,5,2); hold on; plot(p_fastB);
    title('Position: fastB');
    subplot(3,5,7); hold on; plot(v_fastB);
    title('Velocity: fastB');
    subplot(3,5,12); hold on; plot(a_fastB);
    title('Acceleration: fastB');

    subplot(3,5,3); hold on; plot(p_fastC);
    title('Position: fastC');
    subplot(3,5,8); hold on; plot(v_fastC);
    title('Velocity: fastC');
    subplot(3,5,13); hold on; plot(a_fastC);
    title('Acceleration: fastC');

    subplot(3,5,4); hold on; plot(p_fastD);
    title('Position: fastD');
    subplot(3,5,9); hold on; plot(v_fastD);
    title('Velocity: fastD');
    subplot(3,5,14); hold on; plot(a_fastD);
    title('Acceleration: fastD');

    subplot(3,5,5); hold on; plot(p_fastE);
    title('Position: fastE');
```
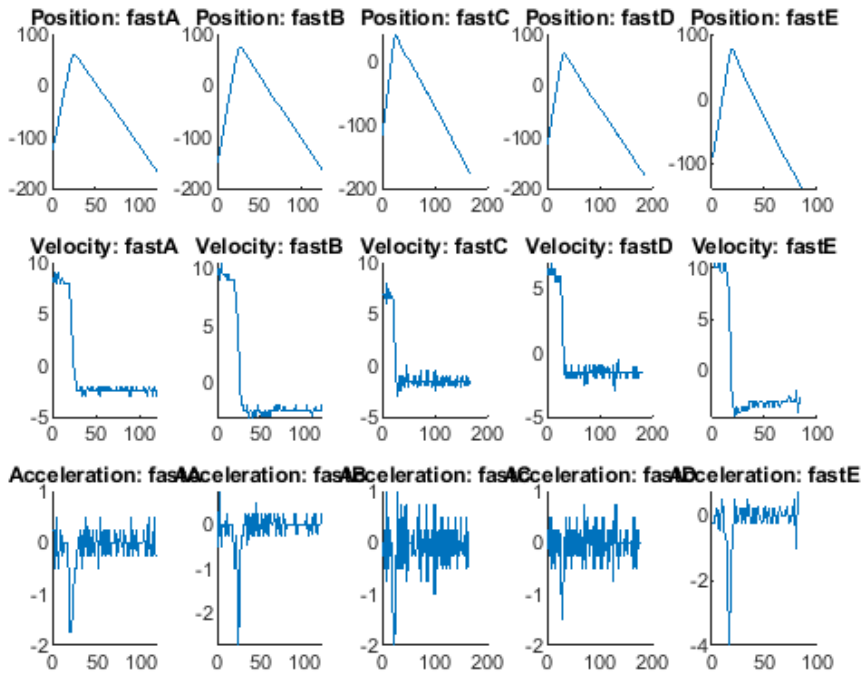
```
    subplot(3,5,10); hold on; plot(v_fastE);
    title('Velocity: fastE');
    subplot(3,5,15); hold on; plot(a_fastE);
    title('Acceleration: fastE');
```


unfiltered slow plot

```
figure(2);
    subplot(3,5,1); hold on; plot(p_slowA);
    title('Position: slowA');
    subplot(3,5,6); hold on; plot(v_slowA);
    title('Velocity: slowA');
    subplot(3,5,11); hold on; plot(a_slowA);
    title('Acceleration: slowA');

    subplot(3,5,2); hold on; plot(p_slowB);
    title('Position: slowB');
    subplot(3,5,7); hold on; plot(v_slowB);
    title('Velocity: slowB');
    subplot(3,5,12); hold on; plot(a_slowB);
    title('Acceleration: slowB');

    subplot(3,5,3); hold on; plot(p_slowC);
    title('Position: slowC');
    subplot(3,5,8); hold on; plot(v_slowC);
    title('Velocity: slowC');
    subplot(3,5,13); hold on; plot(a_slowC);
    title('Acceleration: slowC');

    subplot(3,5,4); hold on; plot(p_slowD);
    title('Position: slowD');
    subplot(3,5,9); hold on; plot(v_slowD);
    title('Velocity: slowD');
    subplot(3,5,14); hold on; plot(a_slowD);
    title('Acceleration: slowD');
```

```matlab
    subplot(3,5,5); hold on; plot(p_slowE);
    title('Position: slowE');
    subplot(3,5,10); hold on; plot(v_slowE);
    title('Velocity: slowE');
    subplot(3,5,15); hold on; plot(a_slowE);
    title('Acceleration: slowE');

for m = 1:2
    figure(m);
    for n = 1:5
        subplot(3,5,n); ylabel('pixels'); xlabel('frame number');
        subplot(3,5,n+5); ylabel('pixels/frame'); xlabel('frame number');
        subplot(3,5,n+10); ylabel('pixels/frame^2'); xlabel('frame number');
    end
end
```

Position: fastA Position: fastB Position: fastC Position: fastD Position: fastE

Velocity: fastA Velocity: fastB Velocity: fastC Velocity: fastD Velocity: fastE

Acceleration: fastA Acceleration: fastB Acceleration: fastC Acceleration: fastD Acceleration: fastE

Position: slowA Position: slowB Position: slowC Position: slowD Position: slowE

Velocity: slowA Velocity: slowB Velocity: slowC Velocity: slowD Velocity: slowE

Acceleration: slowA Acceleration: slowB Acceleration: slowC Acceleration: slowD Acceleration: slowE
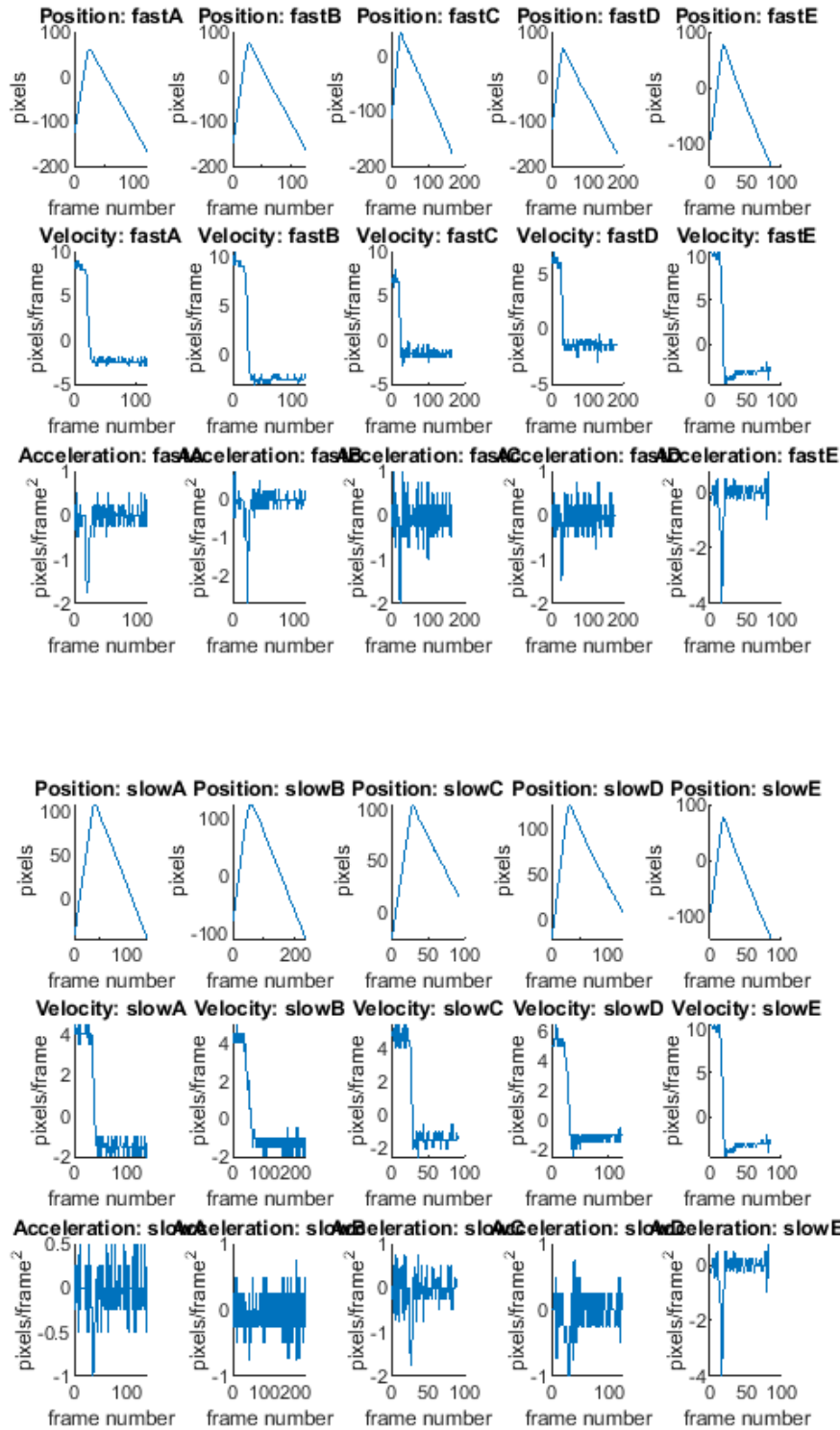
FFT ANALYSIS OF RAW POSITION DATA

```
fft_fastA = abs(fftshift(fft(p_fastA, 4096)));    fft_slowA = abs(fftshift(fft(p_slowA, 4096)));
fft_fastB = abs(fftshift(fft(p_fastB, 4096)));    fft_slowB = abs(fftshift(fft(p_slowB, 4096)));
fft_fastC = abs(fftshift(fft(p_fastC, 4096)));    fft_slowC = abs(fftshift(fft(p_slowC, 4096)));
fft_fastD = abs(fftshift(fft(p_fastD, 4096)));    fft_slowD = abs(fftshift(fft(p_slowD, 4096)));
fft_fastE = abs(fftshift(fft(p_fastE, 4096)));    fft_slowE = abs(fftshift(fft(p_slowE, 4096)));

% frequency range for FFT plot
```
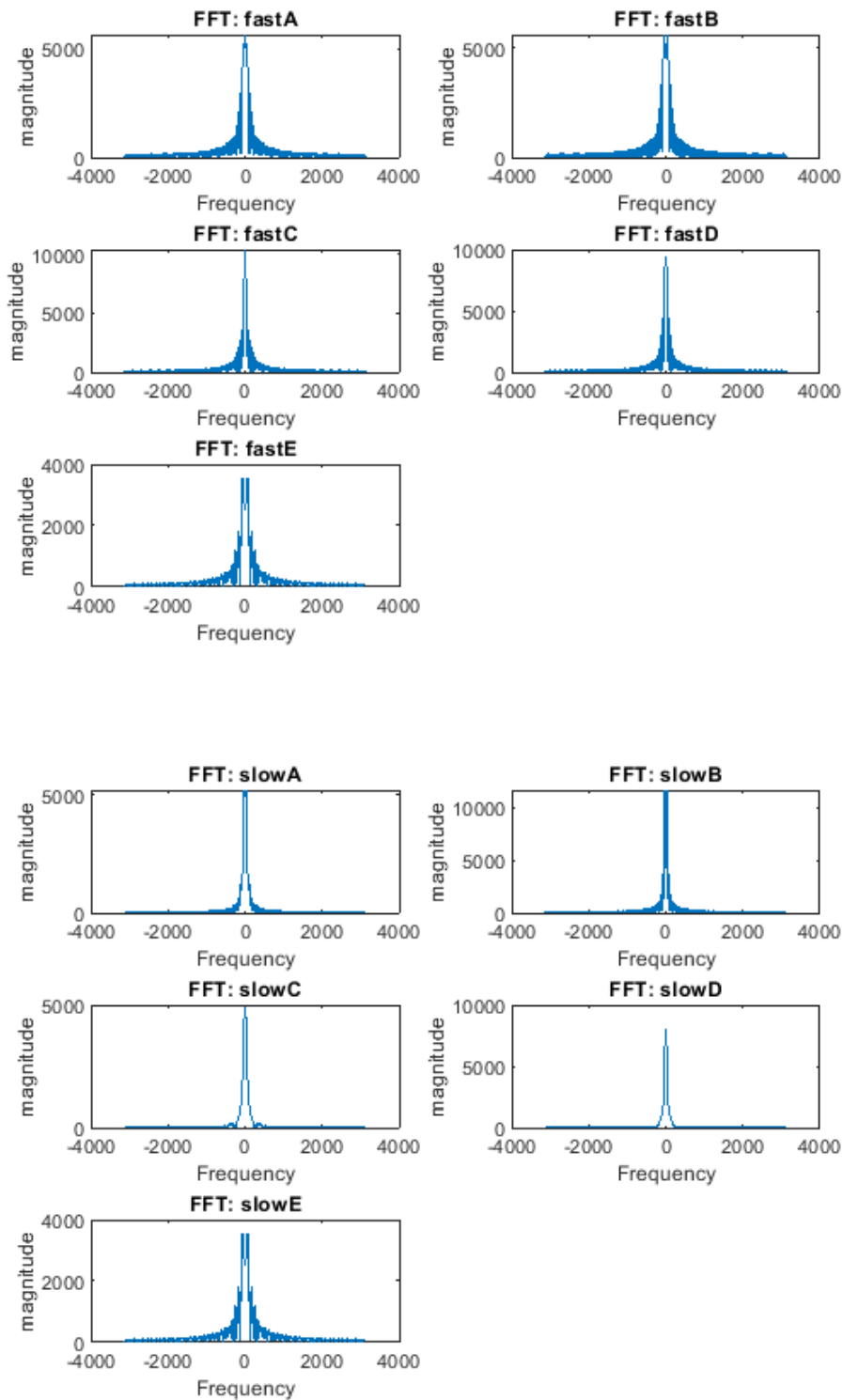
```matlab
% ----------------------------
Fs = 6250; %frames/second, sampling frequency
f = (Fs/4096)*([0:(length(fft_fastA)-1)]'-4096/2);

%  FFT plot
% -------------
figure(3);
subplot(321); plot(f, fft_fastA); title('FFT: fastA');
xlabel('Frequency'); ylabel('magnitude')
subplot(322); plot(f, fft_fastB); title('FFT: fastB');
xlabel('Frequency'); ylabel('magnitude')
subplot(323); plot(f, fft_fastC); title('FFT: fastC');
xlabel('Frequency'); ylabel('magnitude')
subplot(324); plot(f, fft_fastD); title('FFT: fastD');
xlabel('Frequency'); ylabel('magnitude')
subplot(325); plot(f, fft_fastE); title('FFT: fastE');
xlabel('Frequency'); ylabel('magnitude')

%  FFT plot
% -------------
figure(4);
subplot(321); plot(f, fft_slowA); title('FFT: slowA');
xlabel('Frequency'); ylabel('magnitude')
subplot(322); plot(f, fft_slowB); title('FFT: slowB');
xlabel('Frequency'); ylabel('magnitude')
subplot(323); plot(f, fft_slowC); title('FFT: slowC');
xlabel('Frequency'); ylabel('magnitude')
subplot(324); plot(f, fft_slowD); title('FFT: slowD');
xlabel('Frequency'); ylabel('magnitude')
subplot(325); plot(f, fft_slowE); title('FFT: slowE');
xlabel('Frequency'); ylabel('magnitude')
```

FFT: fastA

FFT: fastB

FFT: fastC

FFT: fastD

FFT: fastE

FFT: slowA

FFT: slowB

FFT: slowC

FFT: slowD

FFT: slowE

FILTERS ON POSITON

```
% fast

shape = 'valid';
filt_p_fastA = conv(p_fastA_0,krnl_smooth,shape);
filt_p_fastB = conv(p_fastB_0,krnl_smooth,shape);
filt_p_fastC = conv(p_fastC_0,krnl_smooth,shape);
filt_p_fastD = conv(p_fastD_0,krnl_smooth,shape);
```

```
filt_p_fastE = conv(p_fastE_0,krnl_smooth,shape);

% slow

filt_p_slowA = conv(p_slowA_0,krnl_smooth,shape);
filt_p_slowB = conv(p_slowB_0,krnl_smooth,shape);
filt_p_slowC = conv(p_slowC_0,krnl_smooth,shape);
filt_p_slowD = conv(p_slowD_0,krnl_smooth,shape);
filt_p_slowE = conv(p_slowE_0,krnl_smooth,shape);
```

FILTERED VELOCITY

```
krnl = [1 0 -1]/2;
shape = 'valid';
v_filt_fastA = conv(filt_p_fastA,krnl,shape);
v_filt_slowA = conv(filt_p_slowA,krnl,shape);
v_filt_fastB = conv(filt_p_fastB,krnl,shape);
v_filt_slowB = conv(filt_p_slowB,krnl,shape);
v_filt_fastC = conv(filt_p_fastC,krnl,shape);
v_filt_slowC = conv(filt_p_slowC,krnl,shape);
v_filt_fastD = conv(filt_p_fastD,krnl,shape);
v_filt_slowD = conv(filt_p_slowD,krnl,shape);
v_filt_fastE = conv(filt_p_fastE,krnl,shape);
v_filt_slowE = conv(filt_p_slowE,krnl,shape);
```

FILTERED ACCELERATION

```
a_filt_fastA = conv(v_filt_fastA,krnl,shape);
a_filt_slowA = conv(v_filt_slowA,krnl,shape);
a_filt_fastB = conv(v_filt_fastB,krnl,shape);
a_filt_slowB = conv(v_filt_slowB,krnl,shape);
a_filt_fastC = conv(v_filt_fastC,krnl,shape);
a_filt_slowC = conv(v_filt_slowC,krnl,shape);
a_filt_fastD = conv(v_filt_fastD,krnl,shape);
a_filt_slowD = conv(v_filt_slowD,krnl,shape);
a_filt_fastE = conv(v_filt_fastE,krnl,shape);
a_filt_slowE = conv(v_filt_slowE,krnl,shape);
```

FFT ANALYSIS OF RAW VEL DATA

```
fft_v_fastA = abs(fftshift(fft(v_fastA, 4096)));    fft_v_slowA = abs(fftshift(fft(v_slowA, 4096)));
fft_v_fastB = abs(fftshift(fft(v_fastB, 4096)));    fft_v_slowB = abs(fftshift(fft(v_slowB, 4096)));
fft_v_fastC = abs(fftshift(fft(v_fastC, 4096)));    fft_v_slowC = abs(fftshift(fft(v_slowC, 4096)));
fft_v_fastD = abs(fftshift(fft(v_fastD, 4096)));    fft_v_slowD = abs(fftshift(fft(v_slowD, 4096)));
fft_v_fastE = abs(fftshift(fft(v_fastE, 4096)));    fft_v_slowE = abs(fftshift(fft(v_slowE, 4096)));
```

FFT ANALYSIS OF FILTERED VEL DATA

```
fft_filt_v_fastA = abs(fftshift(fft(v_filt_fastA, 4096)));    fft_filt_v_slowA = abs(fftshift(fft(v_filt_slowA, 4096)));
fft_filt_v_fastB = abs(fftshift(fft(v_filt_fastB, 4096)));    fft_filt_v_slowB = abs(fftshift(fft(v_filt_slowB, 4096)));
fft_filt_v_fastC = abs(fftshift(fft(v_filt_fastC, 4096)));    fft_filt_v_slowC = abs(fftshift(fft(v_filt_slowC, 4096)));
fft_filt_v_fastD = abs(fftshift(fft(v_filt_fastD, 4096)));    fft_filt_v_slowD = abs(fftshift(fft(v_filt_slowD, 4096)));
```

```matlab
fft_filt_v_fastE = abs(fftshift(fft(v_filt_fastE, 4096)));   fft_filt_v_slowE = abs(fftshift(fft(v_filt_slowE, 4096)));

%  FFT plot
% -------------
figure(13);
subplot(321); semilogy(f, fft_v_fastA); title('FFT: V fastA - orig and filtered');
hold on;  semilogy(f, fft_filt_v_fastA,'r')
xlabel('Frequency'); ylabel('log magnitude')
subplot(322); semilogy(f, fft_v_fastB); title('FFT: V fastB - orig and filtered');
hold on;  semilogy(f, fft_filt_v_fastB,'r')
xlabel('Frequency'); ylabel('log magnitude')
subplot(323); semilogy(f, fft_v_fastC); title('FFT: V fastC - orig and filtered');
hold on;  semilogy(f, fft_filt_v_fastC,'r')
xlabel('Frequency'); ylabel('log magnitude')
subplot(324); semilogy(f, fft_v_fastD); title('FFT: V fastD - orig and filtered');
hold on;  semilogy(f, fft_filt_v_fastD,'r')
xlabel('Frequency'); ylabel('log magnitude')
subplot(325); semilogy(f, fft_v_fastE); title('FFT: V fastE - orig and filtered');
hold on;  semilogy(f, fft_filt_v_fastE,'r')
xlabel('Frequency'); ylabel('log magnitude')

%  FFT plot
% -------------
figure(14);
subplot(321); semilogy(f, fft_v_slowA); title('FFT: V slowA - orig and filtered');
hold on;  semilogy(f, fft_filt_v_slowA,'r')
xlabel('Frequency'); ylabel('log magnitude')
subplot(322); semilogy(f, fft_v_slowB); title('FFT: V slowB - orig and filtered');
hold on;  semilogy(f, fft_filt_v_slowB,'r')
xlabel('Frequency'); ylabel('log magnitude')
subplot(323); semilogy(f, fft_v_slowC); title('FFT: V slowC - orig and filtered');
hold on;  semilogy(f, fft_filt_v_slowC,'r')
xlabel('Frequency'); ylabel('log magnitude')
subplot(324); semilogy(f, fft_v_slowD); title('FFT: V slowD - orig and filtered');
hold on;  semilogy(f, fft_filt_v_slowD,'r')
xlabel('Frequency'); ylabel('log magnitude')
subplot(325); semilogy(f, fft_v_slowE); title('FFT: V slowE - orig and filtered');
hold on;  semilogy(f, fft_filt_v_slowE,'r')
xlabel('Frequency'); ylabel('log magnitude')
```

FFT: V fastA - orig and filtered

FFT: V fastB - orig and filtered

FFT: V fastC - orig and filtered

FFT: V fastD - orig and filtered

FFT: V fastE - orig and filtered

FFT: V slowA - orig and filtered

FFT: V slowB - orig and filtered

FFT: V slowC - orig and filtered

FFT: V slowD - orig and filtered

FFT: V slowE - orig and filtered
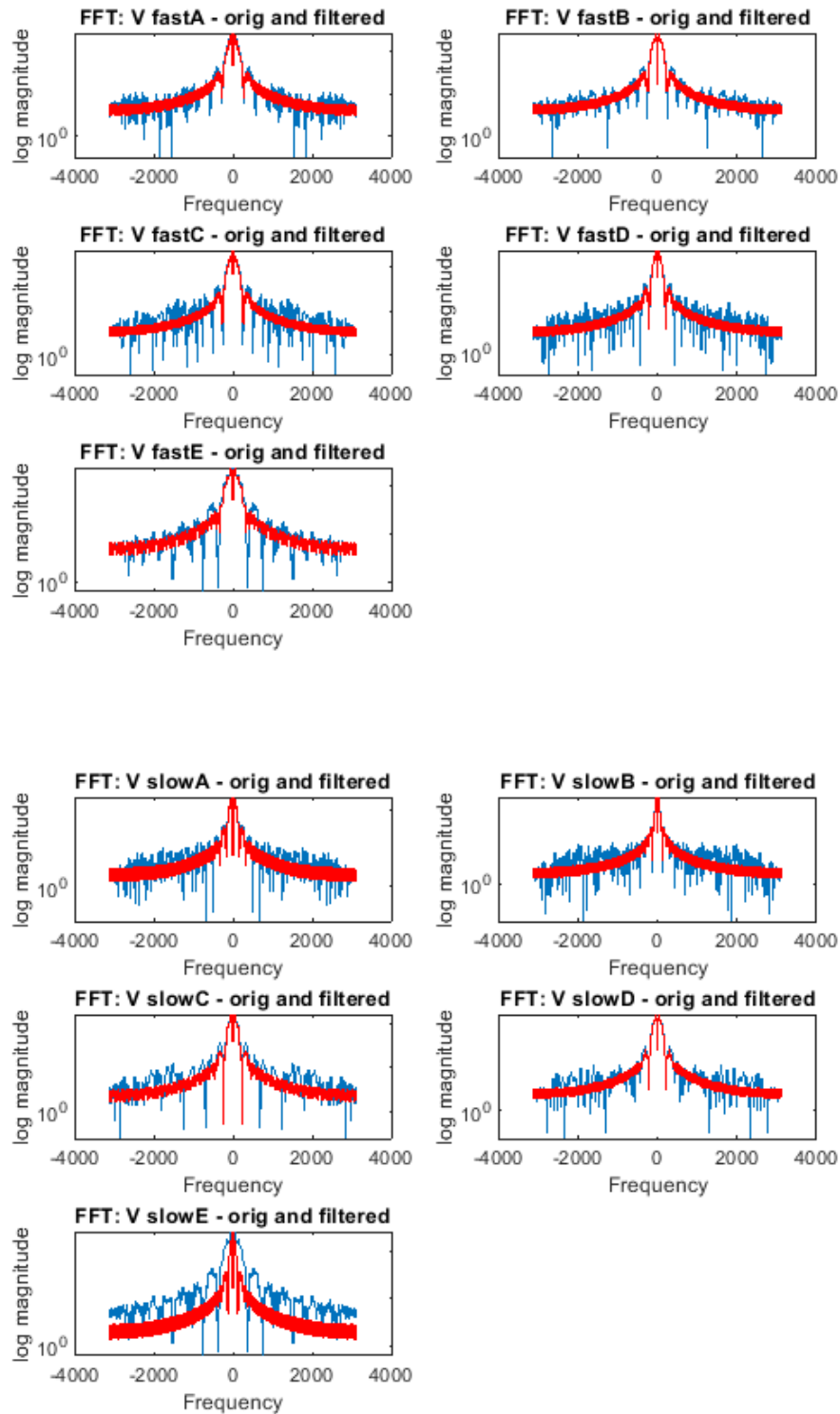
PLOT FILTERED POSITION, VELOCITY, AND ACCELERATION TRACES

```
% filtered fast plot
% ------------------
figure(1);
subplot(3,5,1); plot(filt_p_fastA, 'r');
subplot(3,5,6); plot(v_filt_fastA, 'r');
subplot(3,5,11); plot(a_filt_fastA, 'r');
```

```matlab
subplot(3,5,2); plot(filt_p_fastB, 'r');
subplot(3,5,7); plot(v_filt_fastB, 'r');
subplot(3,5,12); plot(a_filt_fastB, 'r');

subplot(3,5,3); plot(filt_p_fastC, 'r');
subplot(3,5,8); plot(v_filt_fastC, 'r');
subplot(3,5,13); plot(a_filt_fastC, 'r');

subplot(3,5,4); plot(filt_p_fastD, 'r');
subplot(3,5,9); plot(v_filt_fastD, 'r');
subplot(3,5,14); plot(a_filt_fastD, 'r');

subplot(3,5,5); plot(filt_p_fastE, 'r');
subplot(3,5,10); plot(v_filt_fastE, 'r');
subplot(3,5,15); plot(a_filt_fastE, 'r');

% filtered slow plot
% ------------------
figure(2);
subplot(3,5,1); plot(filt_p_slowA, 'r');
subplot(3,5,6); plot(v_filt_slowA, 'r');
subplot(3,5,11); plot(a_filt_slowA, 'r');

subplot(3,5,2); plot(filt_p_slowB, 'r');
subplot(3,5,7); plot(v_filt_slowB, 'r');
subplot(3,5,12); plot(a_filt_slowB, 'r');

subplot(3,5,3); plot(filt_p_slowC, 'r');
subplot(3,5,8); plot(v_filt_slowC, 'r');
subplot(3,5,13); plot(a_filt_slowC, 'r');

subplot(3,5,4); plot(filt_p_slowD, 'r');
subplot(3,5,9); plot(v_filt_slowD, 'r');
subplot(3,5,14); plot(a_filt_slowD, 'r');

subplot(3,5,5); plot(filt_p_slowE, 'r');
subplot(3,5,10); plot(v_filt_slowE, 'r');
subplot(3,5,15); plot(a_filt_slowE, 'r');
```
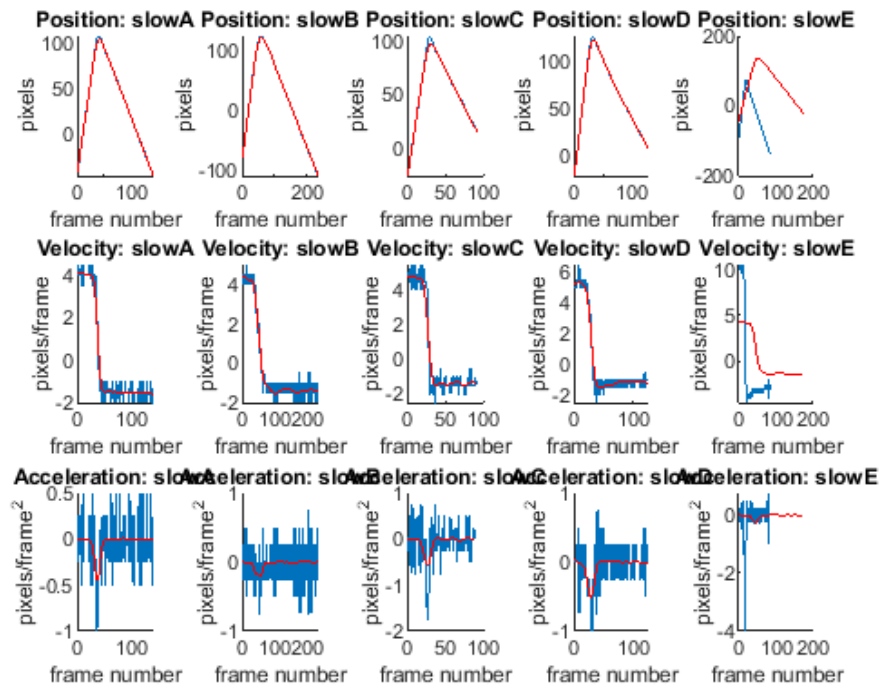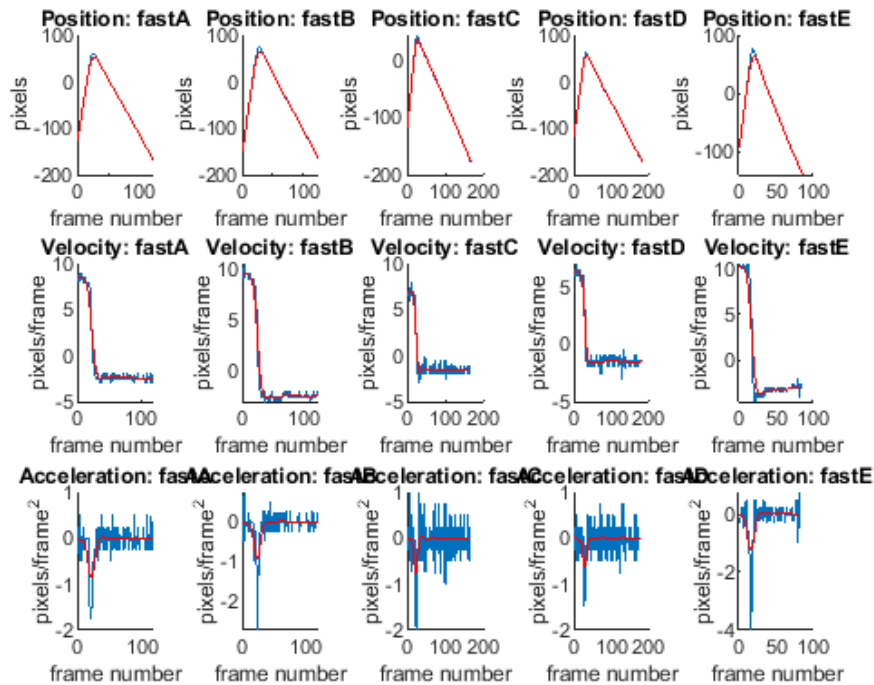
Position: fastA   Position: fastB   Position: fastC   Position: fastD   Position: fastE

Velocity: fastA   Velocity: fastB   Velocity: fastC   Velocity: fastD   Velocity: fastE

Acceleration: fastA   Acceleration: fastB   Acceleration: fastC   Acceleration: fastD   Acceleration: fastE

Position: slowA   Position: slowB   Position: slowC   Position: slowD   Position: slowE

Velocity: slowA   Velocity: slowB   Velocity: slowC   Velocity: slowD   Velocity: slowE

Acceleration: slowA   Acceleration: slowB   Acceleration: slowC   Acceleration: slowD   Acceleration: slowE

just filtered plots

```
figure(11);
subplot(3,5,1); plot(filt_p_fastA, 'r');
                title('Filtered Pos: fastA');
subplot(3,5,6); plot(v_filt_fastA, 'r');
                title('Filtered Vel: fastA');
subplot(3,5,11); plot(a_filt_fastA, 'r');
                title('Filtered Accel: fastA');
```

```matlab
subplot(3,5,2); plot(filt_p_fastB, 'r');
                title('Filtered Pos: fastB');
subplot(3,5,7); plot(v_filt_fastB, 'r');
                title('Filtered Vel: fastB');
subplot(3,5,12); plot(a_filt_fastB, 'r');
                title('Filtered Accel: fastB');

subplot(3,5,3); plot(filt_p_fastC, 'r');
                title('Filtered Pos: fastC');
subplot(3,5,8); plot(v_filt_fastC, 'r');
                title('Filtered Vel: fastC');
subplot(3,5,13); plot(a_filt_fastC, 'r');
                title('Filtered Accel: fastC');

subplot(3,5,4); plot(filt_p_fastD, 'r');
                title('Filtered Pos: fastD');
subplot(3,5,9); plot(v_filt_fastD, 'r');
                title('Filtered Vel: fastD');
subplot(3,5,14); plot(a_filt_fastD, 'r');
                title('Filtered Accel: fastD');

subplot(3,5,5); plot(filt_p_fastE, 'r');
                title('Filtered Pos: fastE');
subplot(3,5,10); plot(v_filt_fastE, 'r');
                title('Filtered Vel: fastE');
subplot(3,5,15); plot(a_filt_fastE, 'r');
                title('Filtered Accel: fastE');

figure(12);
subplot(3,5,1); plot(filt_p_slowA, 'r');
                title('Filtered Pos: slowA');
subplot(3,5,6); plot(v_filt_slowA, 'r');
                title('Filtered Vel: slowA');
subplot(3,5,11); plot(a_filt_slowA, 'r');
                title('Filtered Accel: slowA');

subplot(3,5,2); plot(filt_p_slowB, 'r');
                title('Filtered Pos: slowB');
subplot(3,5,7); plot(v_filt_slowB, 'r');
                title('Filtered Vel: slowB');
subplot(3,5,12); plot(a_filt_slowB, 'r');
                title('Filtered Accel: slowB');

subplot(3,5,3); plot(filt_p_slowC, 'r');
                title('Filtered Pos: slowC');
subplot(3,5,8); plot(v_filt_slowC, 'r');
                title('Filtered Vel: slowC');
subplot(3,5,13); plot(a_filt_slowC, 'r');
                title('Filtered Accel: slowC');

subplot(3,5,4); plot(filt_p_slowD, 'r');
                title('Filtered Pos: slowD');
subplot(3,5,9); plot(v_filt_slowD, 'r');
                title('Filtered Vel: slowD');
subplot(3,5,14); plot(a_filt_slowD, 'r');
                title('Filtered Accel: slowD');

subplot(3,5,5); plot(filt_p_slowE, 'r');
                title('Filtered Pos: slowE');
subplot(3,5,10); plot(v_filt_slowE, 'r');
                title('Filtered Vel: slowE');
subplot(3,5,15); plot(a_filt_slowE, 'r');
                title('Filtered Accel: slowE');

for m = 11:12
    figure(m);
```
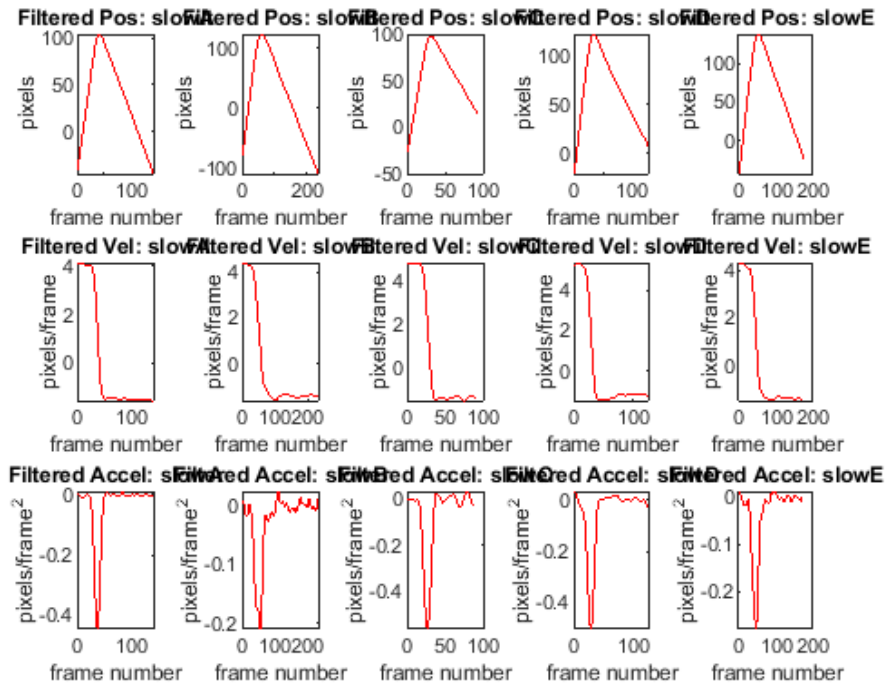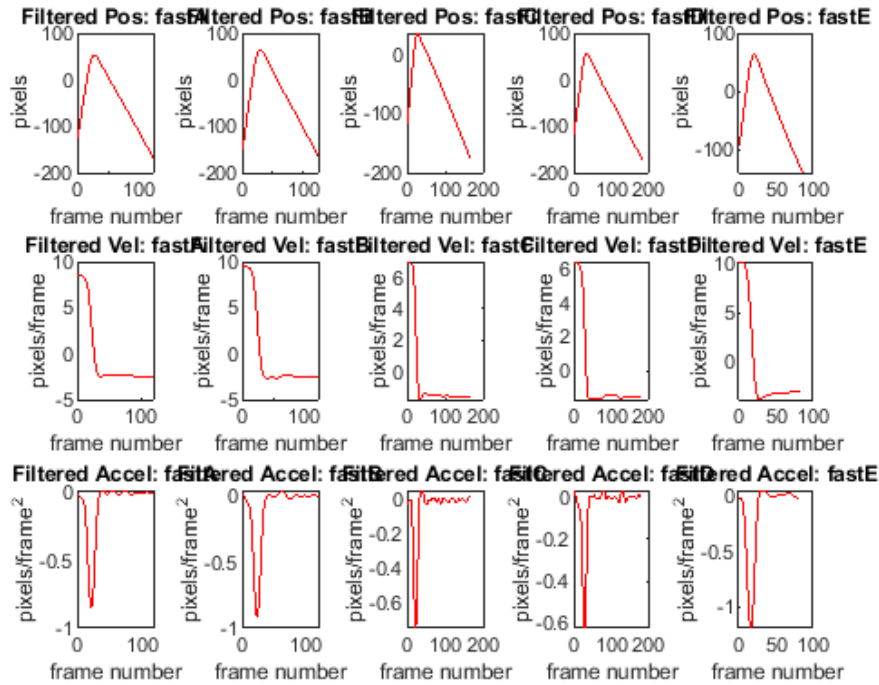
```
    for n = 1:5
        subplot(3,5,n); ylabel('pixels'); xlabel('frame number');
        subplot(3,5,n+5); ylabel('pixels/frame'); xlabel('frame number');
        subplot(3,5,n+10); ylabel('pixels/frame^2'); xlabel('frame number');
    end
end
```


save filtered position, vel, accel data to file

```matlab
csvwrite('filt_p_fastA.csv',filt_p_fastA)
csvwrite('filt_p_fastB.csv',filt_p_fastB)
csvwrite('filt_p_fastC.csv',filt_p_fastC)
csvwrite('filt_p_fastD.csv',filt_p_fastD)
csvwrite('filt_p_fastE.csv',filt_p_fastE)

csvwrite('v_filt_fastA.csv',v_filt_fastA)
csvwrite('v_filt_fastB.csv',v_filt_fastB)
csvwrite('v_filt_fastC.csv',v_filt_fastC)
csvwrite('v_filt_fastD.csv',v_filt_fastD)
csvwrite('v_filt_fastE.csv',v_filt_fastE)

csvwrite('a_filt_fastA.csv',a_filt_fastA)
csvwrite('a_filt_fastB.csv',a_filt_fastB)
csvwrite('a_filt_fastC.csv',a_filt_fastC)
csvwrite('a_filt_fastD.csv',a_filt_fastD)
csvwrite('a_filt_fastE.csv',a_filt_fastE)

%

csvwrite('filt_p_slowA.csv',filt_p_slowA)
csvwrite('filt_p_slowB.csv',filt_p_slowB)
csvwrite('filt_p_slowC.csv',filt_p_slowC)
csvwrite('filt_p_slowD.csv',filt_p_slowD)
csvwrite('filt_p_slowE.csv',filt_p_slowE)

csvwrite('v_filt_slowA.csv',v_filt_slowA)
csvwrite('v_filt_slowB.csv',v_filt_slowB)
csvwrite('v_filt_slowC.csv',v_filt_slowC)
csvwrite('v_filt_slowD.csv',v_filt_slowD)
csvwrite('v_filt_slowE.csv',v_filt_slowE)

csvwrite('a_filt_slowA.csv',a_filt_slowA)
csvwrite('a_filt_slowB.csv',a_filt_slowB)
csvwrite('a_filt_slowC.csv',a_filt_slowC)
csvwrite('a_filt_slowD.csv',a_filt_slowD)
csvwrite('a_filt_slowE.csv',a_filt_slowE)
```