

Contents

- [CM/S x - dir](#)
- [CM/S y dir](#)
- [velo y](#)
- [time array](#)
- [normalized time](#)
- [non dimensionalize particle velocity \(Aaron idea\) so here discharge divided by cross sectional area](#)
- [y velocities](#)
- [XANTHAN GUM X-DIR](#)
- [y direction](#)
- [XANTHAN GUM Y DIR](#)
- [non dimensionalize y](#)

```
clc;
clear all;
close all;
```

```
load("conversionfxg5.mat");
```

```
Error using load
Unable to find file or directory 'conversionfxg5.mat'.
```

```
Error in particle_velo_extractandplots (line 5)
load("conversionfxg5.mat");
```

```
load('velo_xvg05_threshmean.mat');
load("velo_yvg05_threshmean.mat");
```

```
velocity_xavg(:,55:59)=[];
velocity_yavg(:,55:59)=[];
```

CM/S x - dir

```
velo_cm=velocity_xavg./50;
velocitycm=velo_cm.*60;
veloci_cm=velocitycm./length_all;
```

```
save('velo_xcmxg05.mat','veloci_cm');
```

CM/S y dir

```
velo_cmy=velocity_yavg./50;
velocitycmy=velo_cmy.*60;
veloci_cmy=velocitycmy./length_all;
save('velo_ycmxg05.mat','veloci_cmy');
```

```
data0=load('velo_xcmxg0.mat');
data1=load("velo_xcmxg01.mat");
data2=load("velo_xcmxg02.mat");
data3=load("velo_xcmxg03.mat");
data4=load("velo_xcmxg04.mat");
data5=load("velo_xcmxg05.mat");
```

```
velox0=data0.veloci_cm;
velox1=data1.veloci_cm;
velox2=data2.veloci_cm;
velox3=data3.veloci_cm;
velox4=data4.veloci_cm;
velox5=data5.veloci_cm;
```

velo y

```
data6=load('velo_ycmxg0.mat');
data7=load("velo_ycmxg01.mat");
data8=load("velo_ycmxg02.mat");
data9=load("velo_ycmxg03.mat");
data10=load("velo_ycmxg04.mat");
data11=load("velo_ycmxg05.mat");
```

```
veloy0=data6.veloci_cm;
veloy1=data7.veloci_cmy;
veloy2=data8.veloci_cmy;
veloy3=data9.veloci_cmy;
veloy4=data10.veloci_cmy;
veloy5=data11.veloci_cmy;
```

time array

```
time0=load('Timexg0.mat');
time1=load('Timexg01.mat');
time2=load('Timexg02.mat');
time3=load('Timexg03.mat');
time4=load('Timexg04.mat');
time5=load('Timexg05.mat');
```

```
timexg0=time0.time_array;
timexg1=time1.time_array;
timexg2=time2.time_array;
timexg3=time3.time_array;
timexg4=time4.time_array;
timexg5=time5.time_array;
```

normalized time

```
times_norxg0=(timexg0-min(timexg0))/(max(timexg0)-min(timexg0));
times_norxg1=(timexg1-min(timexg1))/(max(timexg1)-min(timexg1));
times_norxg2=(timexg2-min(timexg2))/(max(timexg2)-min(timexg2));
times_norxg3=(timexg3-min(timexg3))/(max(timexg3)-min(timexg3));
times_norxg4=(timexg4-min(timexg4))/(max(timexg4)-min(timexg4));
times_norxg5=(timexg5-min(timexg5))/(max(timexg5)-min(timexg5));
```

```
set(0, 'DefaultAxesFontName', 'TimesNewRoman');
```

non dimensionalize particle velocity (Aaron idea) so here discharge divided by cross sectional area

of the notch

```
velocities=[3.4725;3.4725;3.4725;5.56;6.2645;6.2645]; %cm/s
%non dimensionalize velocities
v0=velox0/3.4735;
v1=velox1/3.4735;
v2=velox2/3.4735;
v3=velox3/5.56;
v4=velox4/6.2645;
v5=velox5/6.2645;
```

y velocities

```
vy0=veloy0/3.4735;
vy1=veloy1/3.4735;
vy2=veloy2/3.4735;
vy3=veloy3/5.56;
vy4=veloy4/6.2645;
vy5=veloy5/6.2645;
```

```
set(0, 'DefaultAxesFontName', 'TimesNewRoman');
figure;
hold on;
colors=orderedcolors('meadow');
markers = {'o', 's', 'd', '^', 'x', '*'};
plot(timexg0, v0, 'Color', colors(1,:), 'Marker', markers{1}, 'LineWidth', 1,'LineStyle', 'none', 'MarkerSize', 5, 'DisplayName', '0% Xanthan Gum');
plot(timexg1, v1, 'Color', colors(2,:), 'Marker', markers{2}, 'LineWidth', 1,'LineStyle', 'none', 'MarkerSize', 5, 'DisplayName', '0.1% Xanthan Gum');
plot(timexg2, v2, 'Color', colors(3,:), 'Marker', markers{3}, 'LineWidth', 1, 'LineStyle', 'none', 'MarkerSize', 5, 'DisplayName', '0.2% Xanthan Gum');
plot(timexg3, v3, 'Color', colors(4,:), 'Marker', markers{4}, 'LineWidth', 1, 'LineStyle', 'none', 'MarkerSize', 5, 'DisplayName', '0.3% Xanthan Gum');
plot(timexg4, v4, 'Color', colors(5,:), 'Marker', markers{5}, 'LineWidth', 1, 'LineStyle', 'none', 'MarkerSize', 5, 'DisplayName', '0.4% Xanthan Gum');
```

```

plot(timexg5, v5, 'Color', colors(6,:), 'Marker', markers{6}, 'LineWidth', 1, 'LineStyle', 'none','MarkerSize', 5, 'DisplayName', '0.5% Xanthan Gum');

set(gca,'FontSize',13);
xlabel('Time (s)', 'FontSize', 13, 'FontWeight', 'normal');
ylabel('Normalized Velocity in Streamwise Direction', 'FontSize', 13, 'FontWeight', 'normal');
%title('Average Channel Widths vs Time for Different Xanthan Gum Concentrations', 'FontSize', 8, 'FontWeight', 'bold');
legend('show', 'Location', 'best');
%grid on;
box on;
saveas(gcf, 'normalizeveloxtime_figurenolegend.png');
hold off;

```

```

set(0, 'DefaultAxesFontName', 'TimesNewRoman');
figure;
hold on;
colors=orderedcolors('meadow');
markers = {'o', 's', 'd', '^', 'x', '*'};
plot(timexg0, velox0, 'Color', colors(1,:), 'Marker', markers{1}, 'LineWidth', 1,'LineStyle', 'none', 'MarkerSize', 5, 'DisplayName', '0% Xanthan Gum');
plot(timexg1, velox1, 'Color', colors(2,:), 'Marker', markers{2}, 'LineWidth', 1,'LineStyle', 'none', 'MarkerSize', 5, 'DisplayName', '0.1% Xanthan Gum');
plot(timexg2, velox2, 'Color', colors(3,:), 'Marker', markers{3}, 'LineWidth', 1, 'LineStyle', 'none','MarkerSize', 5, 'DisplayName', '0.2% Xanthan Gum');
plot(timexg3, velox3, 'Color', colors(4,:), 'Marker', markers{4}, 'LineWidth', 1, 'LineStyle', 'none','MarkerSize', 5, 'DisplayName', '0.3% Xanthan Gum');
plot(timexg4, velox4, 'Color', colors(5,:), 'Marker', markers{5}, 'LineWidth', 1,'LineStyle', 'none', 'MarkerSize', 5, 'DisplayName', '0.4% Xanthan Gum');
plot(timexg5, velox5, 'Color', colors(6,:), 'Marker', markers{6}, 'LineWidth', 1, 'LineStyle', 'none','MarkerSize', 5, 'DisplayName', '0.5% Xanthan Gum');

set(gca,'FontSize',13);
xlabel('Time (s)', 'FontSize', 14, 'FontWeight', 'normal');
ylabel('Velocity in Streamwise Direction(cm/s)', 'FontSize', 14, 'FontWeight', 'normal');
%title('Average Channel Widths vs Time for Different Xanthan Gum Concentrations', 'FontSize', 8, 'FontWeight', 'bold');
legend('show', 'Location', 'best');
%grid on;
box on;
saveas(gcf, 'veloxtime_figurenolegend.png');
hold off;

```

XANTHAN GUM X-DIR

```

set(0, 'DefaultAxesFontName', 'TimesNewRoman');
markers = {'o','s','d','^','p','x'};
Labels = {'25 L/h','25 L/h','25 L/h', '40 L/h','55 L/h','55 L/h'};
Q = [25; 25; 25; 40; 55; 55]; %L/h
xg = [0;1;2;3;4;5];
color_map = containers.Map({25, 40, 55}, {[0 0 1], [0 0.5 0],[1 0 0]});

allvelo_avg = [mean(velox0), mean(velox1), mean(velox2), ...
               nanmean(velox3), nanmean(velox4), mean(velox5)];
allvelo_std = [std(velox0), std(velox1), std(velox2), ...
               nanstd(velox3), std(velox4), std(velox5)];

% Plot
figure;
errorbar(xg, allvelo_avg, allvelo_std, 'k', 'LineStyle', 'none', 'LineWidth', 1,'HandleVisibility', 'off');
hold on;
for i = 1:length(xg)
    disch_color = color_map(Q(i));
    plot(xg(i), allvelo_avg(i), markers{i}, 'Color', disch_color, 'LineWidth', 1, 'MarkerSize', 10, 'DisplayName', labels{i});
end

set(gca,'FontSize',13);
xlabel('% Xanthan Gum', 'FontSize', 12, 'FontWeight', 'normal');
ylabel('Time and Space Averaged Velocity in X (cm/s)', 'FontSize', 12, 'FontWeight', 'normal');
%title('Average Channel Widths vs Time for Different Xanthan Gum Concentrations', 'FontSize', 8, 'FontWeight', 'bold');
legend('show', 'Location', 'best');
grid on;
grid minor;
box on;
saveas(gcf, 'velocityxanthanguminX_time_figurenolegend.png');
hold off;

```

y direction

```

set(0, 'DefaultAxesFontName', 'TimesNewRoman');
figure;
hold on;
colors=orderedcolors('meadow');
markers = {'o', 's', 'd', '^', 'x', '*'};
plot(timexg0, veloy0, 'Color', colors(1,:), 'Marker', markers{1}, 'LineWidth', 1,'LineStyle', 'none', 'MarkerSize', 5, 'DisplayName', '0% Xanthan Gum');
plot(timexg1, veloy1, 'Color', colors(2,:), 'Marker', markers{2}, 'LineWidth', 1,'LineStyle', 'none', 'MarkerSize', 5, 'DisplayName', '0.1% Xanthan Gum');
plot(timexg2, veloy2, 'Color', colors(3,:), 'Marker', markers{3}, 'LineWidth', 1, 'LineStyle', 'none','MarkerSize', 5, 'DisplayName', '0.2% Xanthan Gum');

```

```

plot(timexg3, veloy3, 'Color', colors(4,:), 'Marker', markers{4}, 'LineWidth', 1, 'LineStyle', 'none', 'MarkerSize', 5, 'DisplayName', '0.3% Xanthan Gum');
plot(timexg4, veloy4, 'Color', colors(5,:), 'Marker', markers{5}, 'LineWidth', 1, 'LineStyle', 'none', 'MarkerSize', 5, 'DisplayName', '0.4% Xanthan Gum');
plot(timexg5, veloy5, 'Color', colors(6,:), 'Marker', markers{6}, 'LineWidth', 1, 'LineStyle', 'none', 'MarkerSize', 5, 'DisplayName', '0.5% Xanthan Gum');

set(gca, 'FontSize', 12);
xlabel('Time (s)', 'FontSize', 13, 'FontWeight', 'normal');
ylabel('Velocity in Cross-Stream Direction(cm/s)', 'FontSize', 13, 'FontWeight', 'normal');
%title('Average Channel Widths vs Time for Different Xanthan Gum Concentrations', 'FontSize', 8, 'FontWeight', 'bold');
legend('show', 'Location', 'best');
%grid on;
box on;
saveas(gcf, 'velomvelocitiesinydire_time_figure.png');
hold off;

```

XANTHAN GUM Y DIR

```

set(0, 'DefaultAxesFontName', 'TimesNewRoman');
xg=[0;1;2;3;4;5];
allvelo_avg=[mean(veloy0),mean(veloy1),mean(veloy2),mean(veloy3),mean(veloy4),mean(veloy5)];
figure;
err = 0.1 * ones(size(allvelo_avg));
errorbar(xg, allvelo_avg, err, 'k', 'LineStyle', 'none', 'LineWidth', 1);
hold on
plot(xg(1),allvelo_avg(1),'ko','LineWidth',1,'MarkerSize',6,'DisplayName','0% Xanthan Gum');
plot(xg(2),allvelo_avg(2),'ks','LineWidth',1,'MarkerSize',6,'DisplayName','0.1% Xanthan Gum');
plot(xg(3),allvelo_avg(3),'kd','LineWidth',1,'MarkerSize',6,'DisplayName','0.2% Xanthan Gum');
plot(xg(4),allvelo_avg(4),'k^','LineWidth',1,'MarkerSize',6,'DisplayName','0.3% Xanthan Gum');
plot(xg(5),allvelo_avg(5),'kp','LineWidth',1,'MarkerSize',6,'DisplayName','0.4% Xanthan Gum');
plot(xg(6),allvelo_avg(6),'kx','LineWidth',1,'MarkerSize',6,'DisplayName','0.5% Xanthan Gum');
set(gca, 'FontSize', 12);
xlabel('% Xanthan Gum', 'FontSize', 12, 'FontWeight', 'normal');
ylabel('Time and Space Averaged Velocity in Y (cm/s)', 'FontSize', 11, 'FontWeight', 'normal');
%title('Average Channel Widths vs Time for Different Xanthan Gum Concentrations', 'FontSize', 8, 'FontWeight', 'bold');
%legend('show', 'Location', 'best');
grid on;
grid minor;
box on;
saveas(gcf, 'velocityxanthanguminy_xg_figure_nolegend.png');
hold off;

```

non dimensionalize y

```

set(0, 'DefaultAxesFontName', 'TimesNewRoman');
figure;
hold on;
colors=orderedcolors('meadow');
markers = {'o', 's', 'd', '^', 'x', '*'};
plot(timexg0, vy0, 'Color', colors(1,:), 'Marker', markers{1}, 'LineWidth', 1, 'LineStyle', 'none', 'MarkerSize', 5, 'DisplayName', '0% Xanthan Gum');
plot(timexg1, vy1, 'Color', colors(2,:), 'Marker', markers{2}, 'LineWidth', 1, 'LineStyle', 'none', 'MarkerSize', 5, 'DisplayName', '0.1% Xanthan Gum');
plot(timexg2, vy2, 'Color', colors(3,:), 'Marker', markers{3}, 'LineWidth', 1, 'LineStyle', 'none', 'MarkerSize', 5, 'DisplayName', '0.2% Xanthan Gum');
plot(timexg3, vy3, 'Color', colors(4,:), 'Marker', markers{4}, 'LineWidth', 1, 'LineStyle', 'none', 'MarkerSize', 5, 'DisplayName', '0.3% Xanthan Gum');
plot(timexg4, vy4, 'Color', colors(5,:), 'Marker', markers{5}, 'LineWidth', 1, 'LineStyle', 'none', 'MarkerSize', 5, 'DisplayName', '0.4% Xanthan Gum');
plot(timexg5, vy5, 'Color', colors(6,:), 'Marker', markers{6}, 'LineWidth', 1, 'LineStyle', 'none', 'MarkerSize', 5, 'DisplayName', '0.5% Xanthan Gum');

set(gca, 'FontSize', 13);
xlabel('Time (s)', 'FontSize', 13, 'FontWeight', 'normal');
ylabel('Normalized Velocity in Cross-Stream Direction', 'FontSize', 13, 'FontWeight', 'normal');
%title('Average Channel Widths vs Time for Different Xanthan Gum Concentrations', 'FontSize', 8, 'FontWeight', 'bold');
legend('show', 'Location', 'best');
%grid on;
box on;
saveas(gcf, 'normalizevelocitytime_figure_nolegend.png');
hold off;

```

```

set(0, 'DefaultAxesFontName', 'TimesNewRoman');
markers = {'o', 's', 'd', '^', 'p', 'x'};
labels = {'25 L/h', '25 L/h', '25 L/h', '40 L/h', '55 L/h', '55 L/h'};
Q = [25; 25; 25; 40; 55; 55]; %l/h
xg = [0;1;2;3;4;5];
color_map = containers.Map({25, 40, 55}, {[0 0 1], [0 0.5 0], [1 0 0]});

allvelo_avg = [mean(veloy0), mean(veloy1), mean(veloy2), ...
               nanmean(veloy3), nanmean(veloy4), mean(veloy5)];
allvelo_std = [std(veloy0), std(veloy1), std(veloy2), ...
               nanstd(veloy3), std(veloy4), std(veloy5)];

% Plot
figure;

```

```
errorbar(xg, allvelo_avg, allvelo_std, 'k', 'LineStyle', 'none', 'LineWidth', 1, 'HandleVisibility', 'off');
hold on;
for i = 1:length(xg)
    disch_color = color_map(Q(i));
    plot(xg(i), allvelo_avg(i), markers{i}, 'Color', disch_color, 'LineWidth', 1, 'MarkerSize', 10, 'DisplayName', labels{i});
end

set(gca, 'FontSize', 13);
xlabel('% Xanthan Gum', 'FontSize', 12, 'FontWeight', 'normal');
ylabel('Time and Space Averaged Velocity in Y (cm/s)', 'FontSize', 12, 'FontWeight', 'normal');
%title('Average Channel Widths vs Time for Different Xanthan Gum Concentrations', 'FontSize', 8, 'FontWeight', 'bold');
legend('show', 'Location', 'best');
grid on;
grid minor;
box on;
saveas(gcf, 'velocityxanthanguminY_time_figure.png');
hold off;
```

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