

READ ME.

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MATLAB File Name: mSMC_Calcium_Influx_2022

MATLAB version: Matlab2020a (or more recent)

Programming language: MATLAB

The code described in this document should be used for research purposes only and is currently available through the following links.

- https://github.com/ydu1955/Piezo1_mSMC_Calcium-Influx/tree/MATLAB_Piezo1_YD
- DOI: 10.5281/zenodo.6282081 (MIT License)

Installation and use instructions:

This code was written using a student license for MATLAB 2020a and installation instructions can be found through MathWorks website. The Symbolic Math Toolbox will also need to be downloaded after MATLAB is installed. The file can then be added to MATLAB pathway and opened in editor for use.

Green line commentary text is available for each section of code and variable that needs to be adjusted/changed both at the beginning of every section and for relevant lines. The file referenced by the code must be in “.txt” format and data sorted in the first 2 columns without labels, time and intensity, respectively. Crucial lines to note are listed below.

- The text file's name must be changed in lines 18-20
- Line 53 for baseline calculation and line 54 for manual input (remember to disable line 54 if you decide to calculate baseline).
- Line 55 to adjust datapoint detection for peak bases (typically between 0-0.1)
- Line 65 to adjust cutoff multiplier to determine threshold for peaks (typically a value between 1.0-1.5)

When everything is ready, the calculated variables and arrays for the time and intensity can be exported as an “.xls” file. Column and sheet number can be changed as needed. There are no labels in exported file, reference Lines 219-229 from MATLAB code for column labels.

Please note, this code has not been submitted for community commenting and input.

Description:

The key operations of the code are identifying peaks in mSMC calcium influx signaling. First, the baseline is identified through manual input or by calculating the lowest average after dividing the curve into small segments, see Installation/use instructions for more details. Next, a multiplier is used to mark a threshold where datapoints above this threshold are filtered using for loops to find peaks. Datapoints left and right of peak datapoint are filtered using for loop conditions to estimate where peak bases are. Peaks, peak bases, and baseline are graphed in a figure for confirmation. All data points are saved in separate arrays where they can be used to calculate the intensity change, time between calcium spikes, time duration of peaks, frequency

and roughly estimate the area under the curve. This code is best used for calcium curves with low background noise and relatively cleaner curves. Messier curves or curves with sloping baselines might require manual deletion/manipulation of datapoints from the original curve without biasing the final calculated variables.

Example Data

The following is a sample of our mSMC PiezoWT calcium influx signal data with a figure to demonstrate the primary function of the code. Numerical values calculated based on the arrays generated (visualized in the figure) are exported in a separate “.xls” file.

File name: [Example_mSMCs_WT_04.txt](#) (included below)

Adjusted Lines:

- **Lines 18-20:** [Example_mSMCs_WT_04.txt](#)
- **Line 54:** 556
- **Line 55:** 0.03
- **Line 65:** 1.255

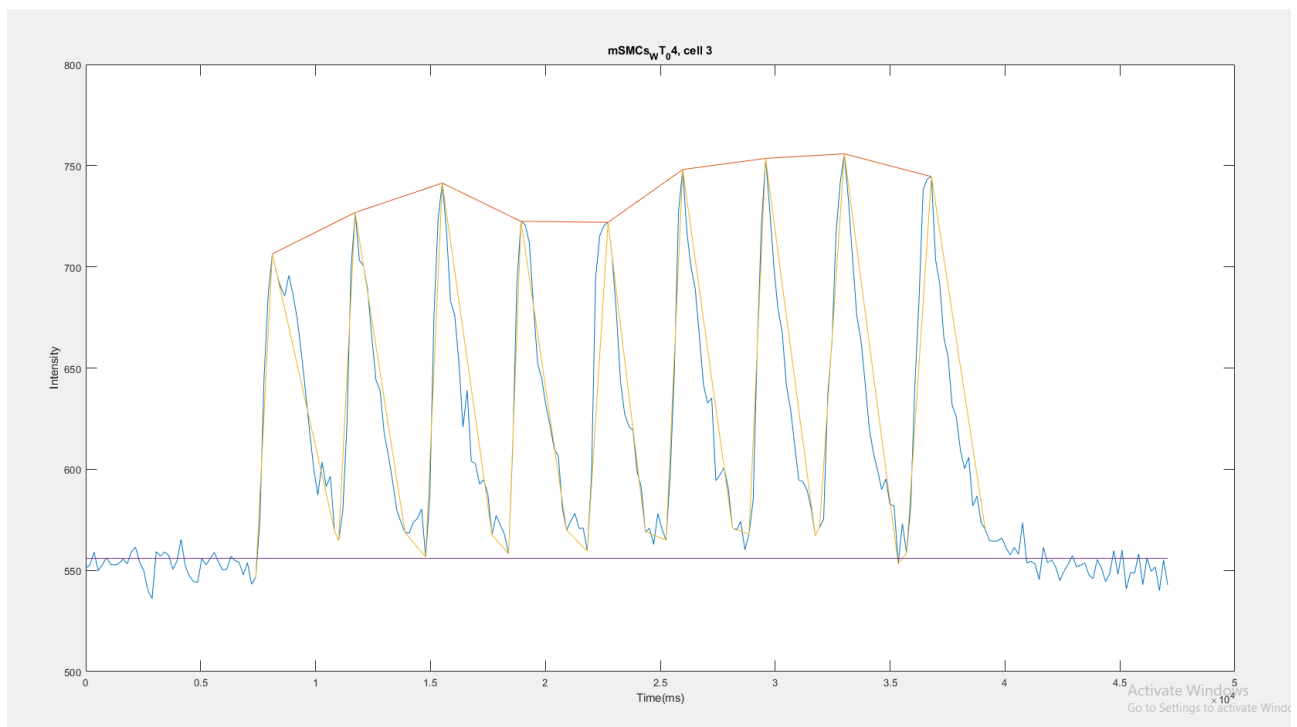
Figure:

Blue Curve: Original curve exported from zeiss software

Purple Curve: Baseline

Orange Curve: Identified peak datapoints

Yellow Curve: Identified peak and peak base datapoints



Example_mSMCs_WT_04.txt

0	551.0967742
180.0103	552.7741935
361.0206	558.9677419
541.0309	549.8709677
721.0412	552.8064516
902.0516	556.2903226
1082.0619	552.9354839
1262.0722	552.6774194
1443.0825	553.3870968
1623.0928	555.6451613
1804.1032	553.2903226
1984.1135	559.1935484
2164.1238	561.4516129
2345.1341	553.9677419
2525.1444	549.8709677
2705.1547	540.0322581
2886.1651	536.0967742
3066.1754	559.2580645
3247.1857	557.0322581
3427.196	559.1290323
3607.2063	557.4193548
3788.2167	550.516129
3968.227	554.5806452
4148.2373	565.3548387
4329.2476	552.1290323
4509.2579	547.2258065
4689.2682	544.483871
4870.2786	544.1290323
5050.2889	556.0322581

5231.2992	552.6774194
5411.3095	555.8064516
5591.3198	558.8387097
5772.3302	554.1290323
5952.3404	550.2903226
6132.3507	550.483871
6313.3611	556.9354839
6493.3714	554.9032258
6673.3817	553.9677419
6854.392	547.7419355
7034.4023	553.7741935
7215.4127	543.1612903
7395.423	546.5483871
7575.4333	574.3548387
7756.4436	644.3870968
7936.4539	686.0967742
8116.4642	706.3548387
8297.4746	696.9032258
8477.4849	690
8658.4952	685.6129032
8838.5055	695.8064516
9018.5158	686.2258065
9199.5262	674.4193548
9379.5365	657.6451613
9559.5468	638.5483871
9740.5571	618.6129032
9920.5674	600.1935484
10100.5777	587.1935484
10281.5881	603.5806452
10461.5984	591.4193548

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10822.619	569.6774194
11002.6293	564.6774194
11183.6397	579.3548387
11363.65	621.9032258
11543.6603	699.6129032
11724.6706	726.8387097
11904.6809	703.2580645
12085.6913	700.516129
12265.7016	688.6129032
12445.7118	665.4516129
12626.7222	644.1612903
12806.7325	638.7741935
12986.7428	617.7741935
13167.7531	606.8387097
13347.7634	594.2258065
13527.7737	579.9354839
13708.7841	574.0967742
13888.7944	568.8387097
14068.8047	568.3225806
14249.815	573.7419355
14429.8253	575.6129032
14610.8357	580.3225806
14790.846	556.5806452
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15151.8666	675.7741935
15331.8769	723.7419355
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15692.8976	718.4516129
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16053.9182	676.1290323
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16413.9388	620.7419355
16594.9492	639
16774.9595	604
16954.9698	602.6451613
17135.9801	592.6451613
17315.9904	594.7741935
17496.0007	587.7741935
17677.0111	567.516129
17857.0214	577.1290323
18038.0317	572.4516129
18218.042	567.9677419
18398.0523	558.1935484
18579.0627	611.1612903
18759.0729	691.6129032
18939.0832	722.483871
19120.0936	720.7741935
19300.1039	711.9032258
19481.1142	680.8387097
19661.1245	652.3548387
19841.1348	644.6129032
20022.1452	631.516129
20202.1555	621.5483871
20382.1658	610.0645161
20563.1761	606.3870968
20743.1864	580.3548387
20923.1967	569.9032258
21104.2071	574.3870968
21284.2174	578.1290323

21464.2277	570.7096774
21645.238	570.9677419
21825.2483	559.5483871
22006.2587	596.8387097
22186.269	694.7419355
22366.2793	715.3870968
22547.2896	720.3870968
22727.2999	721.9677419
22907.3102	704.5483871
23088.3206	677.4193548
23268.3309	643.1612903
23449.3412	627.3225806
23629.3515	621.0645161
23809.3618	619.3225806
23990.3722	598.9032258
24170.3825	591.0322581
24350.3928	569.1612903
24531.4031	570.8064516
24711.4134	562.8387097
24892.4238	578.1290323
25072.4341	570.4193548
25252.4443	564.9677419
25433.4547	598.2580645
25613.465	649.0967742
25793.4753	727.4193548
25974.4856	748.0967742
26154.4959	717.4516129
26334.5062	700.0322581
26515.5166	689.5483871
26695.5269	666.483871

26876.5372	641.8709677
27056.5475	632.7096774
27236.5578	635.1935484
27417.5682	594.3870968
27597.5785	597.2258065
27777.5888	600.7419355
27958.5991	590.4193548
28138.6094	571.0645161
28319.6198	569.9354839
28499.6301	574.2580645
28679.6404	560.2580645
28860.6507	567.8709677
29040.661	584.8064516
29220.6713	660.7419355
29401.6817	720.9677419
29581.692	753.5806452
29761.7023	728.1290323
29942.7126	699.9677419
30122.7229	678.7741935
30302.7332	667.8709677
30483.7436	641.5806452
30663.7539	630
30844.7642	612.1935484
31024.7745	594.7419355
31204.7848	593.7741935
31385.7952	589.7419355
31565.8055	580.483871
31745.8157	567.1935484
31926.8261	571.0967742
32106.8364	575.3548387

32287.8468	637
32467.857	662.1290323
32647.8673	716.7096774
32828.8777	741.6451613
33008.888	755.8387097
33188.8983	732.5483871
33369.9086	703.3548387
33549.9189	675.8387097
33729.9292	663.8064516
33910.9396	642.9032258
34090.9499	620.3870968
34271.9602	607.9354839
34451.9705	599.516129
34631.9808	589.9677419
34812.9912	595.1935484
34993.0015	582.6129032
35173.0118	581.8387097
35354.0221	553.2580645
35534.0324	573.0322581
35715.0428	558.6129032
35895.0531	581.5483871
36075.0634	641.1290323
36256.0737	683.0645161
36436.084	738.0967742
36616.0943	743.4193548
36797.1047	744.5806452
36977.115	703.4516129
37157.1253	691.8709677
37338.1356	665
37518.1459	655.6451613

37698.1562	631.6129032
37879.1666	625.8709677
38059.1769	609.4193548
38240.1872	600.2580645
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38600.2078	581.8387097
38781.2182	586.8064516
38961.2284	573.6129032
39141.2387	570.1935484
39322.2491	564.7741935
39502.2594	564.4193548
39683.2697	564.6451613
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40043.2903	561.1290323
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40404.311	561.4193548
40584.3213	557.9354839
40765.3316	573.5483871
40945.3419	553.6774194
41125.3522	554.483871
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41486.3729	545.3870968
41667.3832	561.4193548
41847.3935	553.8709677
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42388.4245	544.9354839
42568.4348	549.6774194
42749.4451	553.0967742
42929.4554	557.2903226

43110.4658	551.7741935
43290.4761	552.5483871
43470.4864	553.6451613
43651.4967	547.7419355
43831.507	545.9032258
44011.5173	555.3870968
44192.5277	551.3225806
44372.538	544.5483871
44552.5483	548.1935484
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44913.5689	548.0967742
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45454.5998	548.9354839
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45815.6205	558.1612903
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46536.6617	551.7096774
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