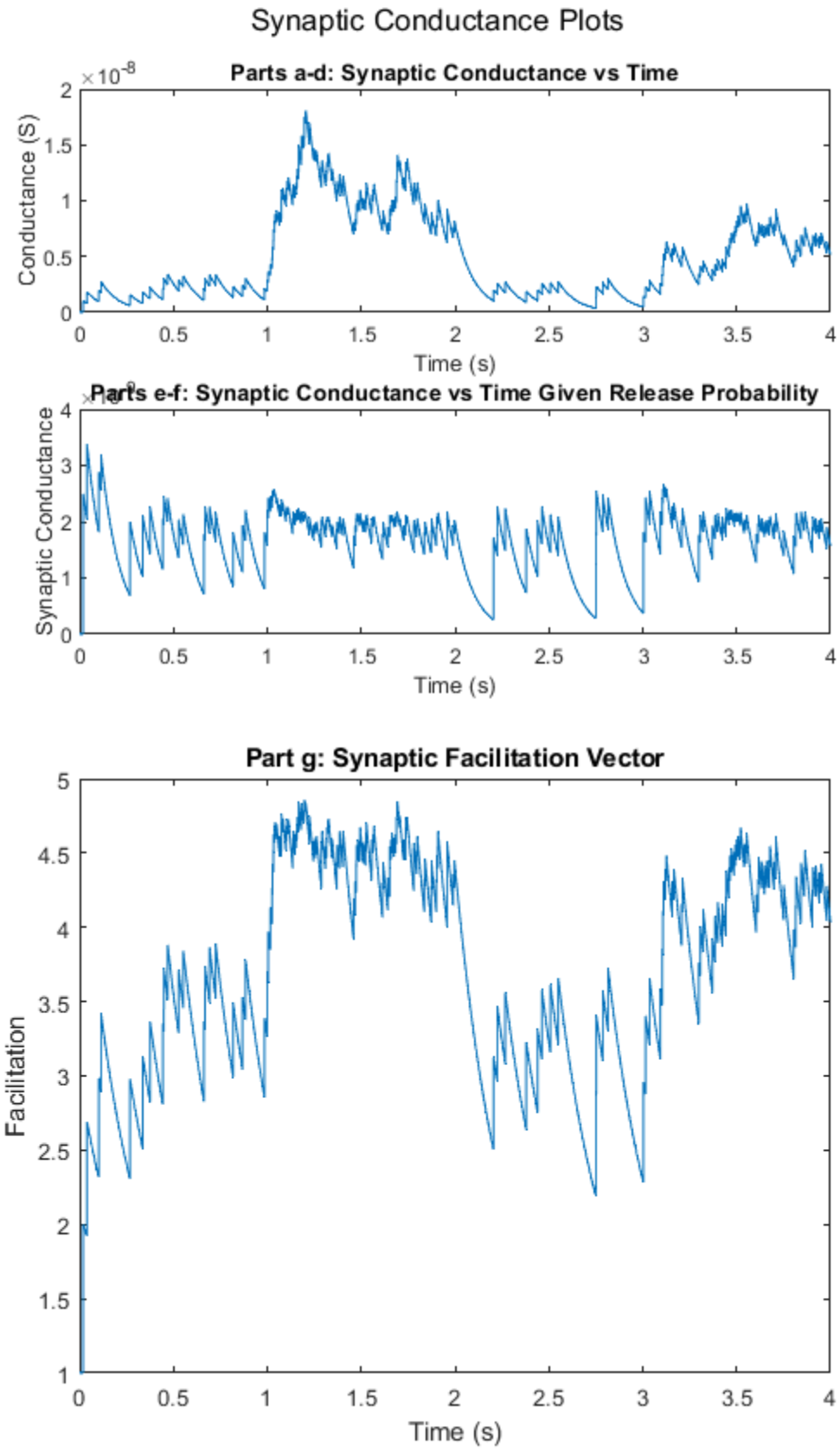
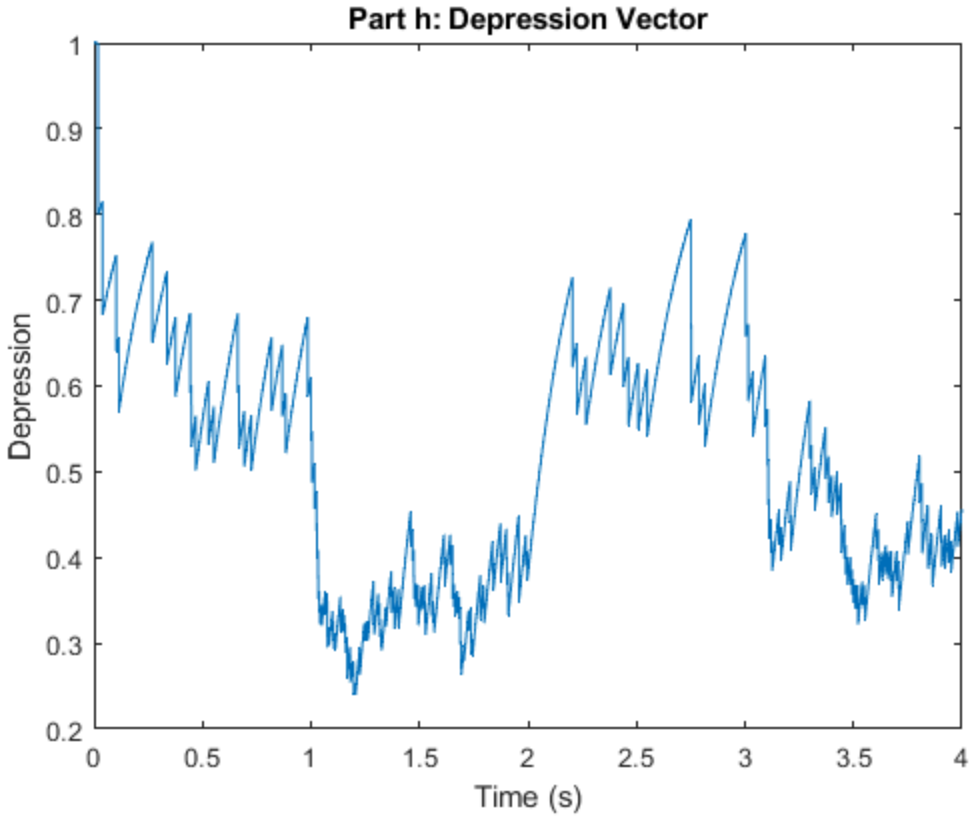
Lab 8 - Tutorial 5.1

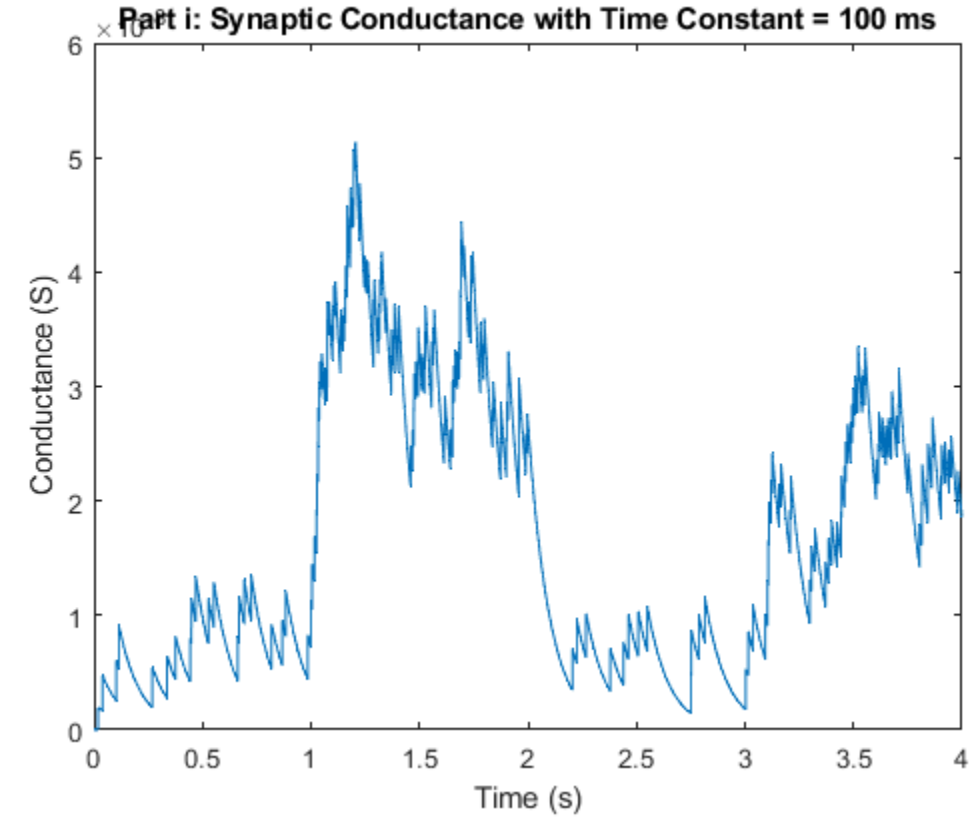
```
% Release Probability (Part: e)
p0 = 0.5; % Release probability
Dvec = zeros(size(tvec));
Dvec(1) = 1;
tau_D = 0.25; % seconds

for i = 2:length(tvec)
    dD_over_dt = (1 - Dvec(i-1)) / tau_D;
    Dvec(i) = Dvec(i-1) + dD_over_dt * dt;

    if spikes(i) == 1
        Dvec(i) = Dvec(i) - p0 * Dvec(i);
    end
end

% Second Synaptic Conductance Vector (Part: f)
% Define parameters
dG_max = 5e-9; % 5nS
tau = 100 * 10^-3; % 100ms

% Define vectors
Gsyn2 = zeros(size(tvec));
Gsyn2(1) = 0; % No conductance

% Euler's method
for i = 2:length(tvec)
    dG = dG_max * p0 * Dvec(i-1); % 1nS increments
    dGsyn2_over_dt = -1 * Gsyn2(i-1) / tau;
    Gsyn2(i) = Gsyn2(i-1) + dGsyn2_over_dt * dt;

    if spikes(i) == 1
        Gsyn2(i) = Gsyn2(i) + dG;
    end
end

% Part a-d plot
figure;
subplot(2,1,1);
plot(tvec, Gsyn);
title('Parts a-d: Synaptic Conductance vs Time')
xlabel('Time (s)')
ylabel('Conductance (S)')

% Part e-f plot
subplot(2,1,2);
plot(tvec, Gsyn2);
title('Parts e-f: Synaptic Conductance vs Time Given Release Probability')
xlabel('Time (s)')
ylabel('Synaptic Conductance')
```

```
sgtitle('Synaptic Conductance Plots')

% Synaptic Facilitation Vector (Part: g)
% Define parameters
p0F = 0.2;
Ffac = 0.25;
F_max = 1 / p0F; % 5nS
tau_F = 0.25; % seconds

% Define vectors
Fvec = zeros(size(tvec));
Fvec(1) = 1; % Initial value as 1

for i = 2:length(tvec)
    dF_over_dt = (1 - Fvec(i-1)) / tau_F;
    Fvec(i) = Fvec(i-1) + dF_over_dt * dt;

    if spikes(i) == 1
        Fvec(i) = Fvec(i) + Ffac * (F_max - Fvec(i-1));
    end
end

% Part g plot
figure;
plot(tvec, Fvec);
title('Part g: Synaptic Facilitation Vector');
xlabel('Time (s)');
ylabel('Facilitation');


% Synaptic Depression Vector (Part: h)
% Define parameters
p0D = 0.2; % Release Probability
Dfac = 0.25;
D_max = 1 / p0D;
tau_D = 0.25;

% Define vectors
Dvec = zeros(size(tvec)); % Depression Vector
Dvec(1) = 1;

for i = 2:length(tvec)
    dD_over_dt = (1 - Dvec(i-1)) / tau_D;
    Dvec(i) = Dvec(i-1) + dD_over_dt * dt;

    if spikes(i) == 1
        Dvec(i) = Dvec(i) - (p0D * Dvec(i - 1) * Dvec(i - 1));
    end
end

% part h plot
figure;
plot(tvec, Dvec);
title('Part h: Depression Vector');
```

```
xlabel('Time (s)');
ylabel('Depression');

% Third Synaptic Confuctance Vector (Part: i)

% Define parameters
dG3_max = 4e-9; % 5nS
tau_i = 100 * 10^-3; % 100ms

% Define vectors
Gsyn3 = zeros(size(tvec));
Gsyn3(1) = 0; % No conductance

% Euler's method
for i = 2:length(tvec)
    dG_over_dt = (1 - Gsyn3(i - 1)) / tau_i;
    dG = dG3_max * p0 * Fvec(i-1) * Dvec(i-1); % 1nS increments
    dGsyn3_over_dt = -1 * Gsyn3(i-1) / i_tau;
    Gsyn3(i) = Gsyn3(i-1) + dGsyn3_over_dt * dt;

    if spikes(i) == 1
        Gsyn3(i) = Gsyn3(i) + dG;
    end
end

% Plot
figure;
plot(tvec, Gsyn3);
title('Part i: Synaptic Conductance with Time Constant = 100 ms');
xlabel('Time (s)');
ylabel('Conductance (S)');
```


Synaptic Conductance Plots
Parts a-d: Synaptic Conductance vs Time
×10^-8
Conductance (S)
Time (s)
Parts e-f: Synaptic Conductance vs Time Given Release Probability
Synaptic Conductance
Time (s)
Part g: Synaptic Facilitation Vector
Facilitation
Time (s)


Part h: Depression Vector
Depression
Time (s)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0
0.5
1
1.5
2
2.5
3
3.5
4


Part i: Synaptic Conductance with Time Constant = 100 ms
Conductance (S)
Time (s)
6
5
4
3
2
1
0
0
0.5
1
1.5
2
2.5
3
3.5
4

Published with MATLAB® R2022b