For CSTR Pulse

```
clc
clear

% reactor properties
v=1;
V =220;
tau = V/v;

% for pulse
C_pulse = [99    680    1085    1318    1385    1400    1387    1360    1331    1283    1247
]; %an array of values given by TA
time_pulse = [0    10    20    30    40    50    60    70    80    90    100    110    120
];% an array of corresponding time values

len = length(C_pulse);

% Resident Time Distribution
sum =0;
for i=1:len-1
    sum = sum + (time_pulse(i+1)-time_pulse(i))*(C_pulse(i+1)+C_pulse(i))/2;
end
sum
```

```
sum = 542995
```

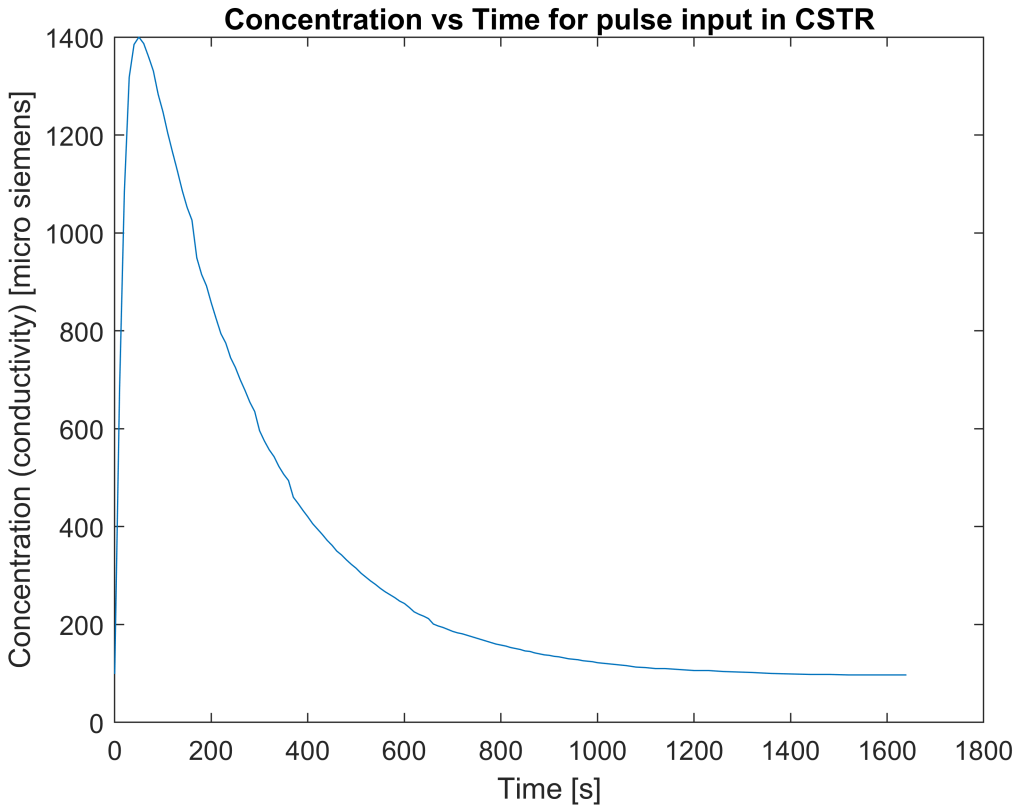
```
E_exp = C_pulse/sum;
E_exp = E_exp';

% Theroretical Calculations
E_theo = (exp(-time_pulse/tau)/tau)';

% for t_mean
sum_t = 0;
for i = 1:len-1
sum_t = sum_t + (time_pulse(i+1)+time_pulse(i))*(time_pulse(i+1)-time_pulse(i))*(C_pulse(i+1)+C
end

t_mean = sum_t/sum
```

```
t_mean = 418.0183
```

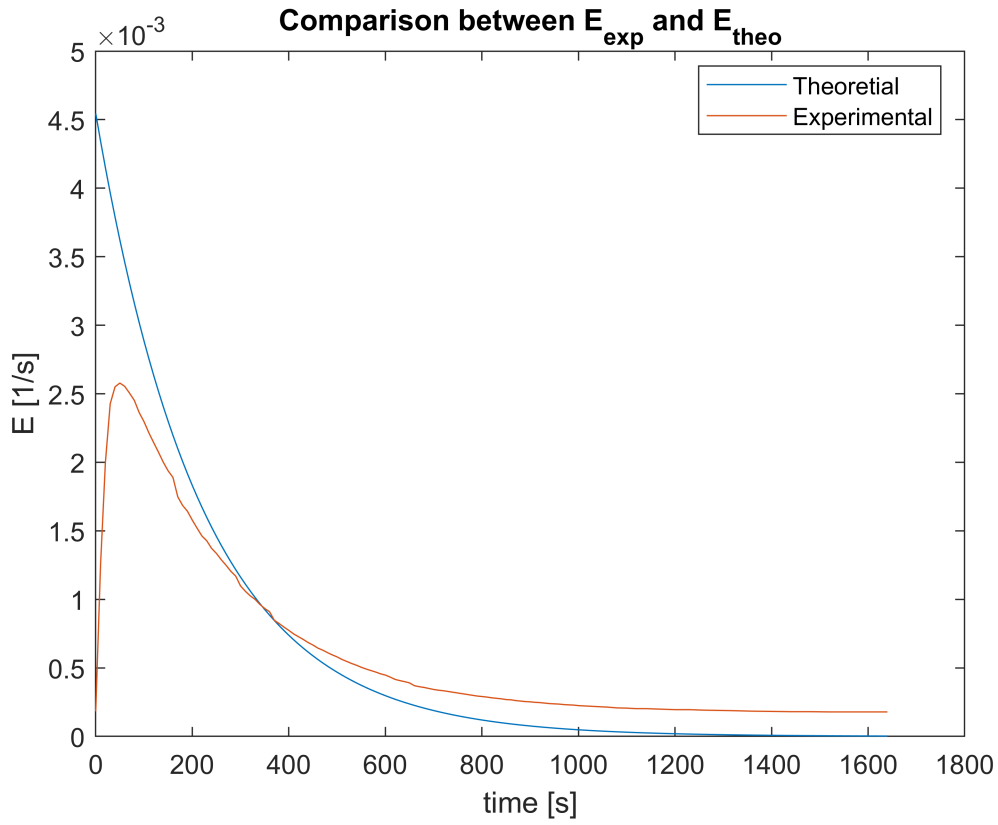
```
% Variance calulation tiem

sum_v =0;
for i = 1:len-1
sum_v = sum_v + ((time_pulse(i+1)+time_pulse(i))^2)*(time_pulse(i+1)-time_pulse(i))*(C_pulse(i-
end

variance = sum_v/sum - t_mean^(2)
```

```
variance = 1.6757e+05
```

```
% Plotting Concentrations
plot(time_pulse,C_pulse)
xlabel("Time [s]")
ylabel("Concentration (conductivity) [micro siemens]")
title("Concentration vs Time for pulse input in CSTR")
```



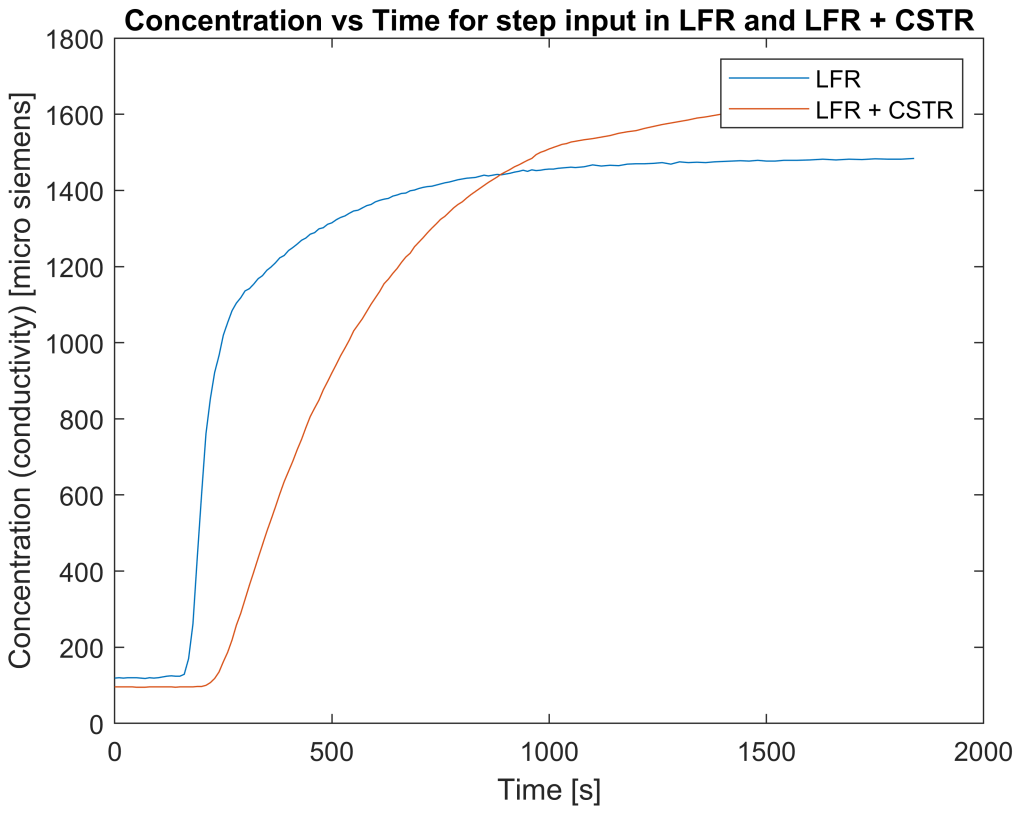

```
% plotting E_exp and E_theo
plot(time_pulse, E_theo)
hold on
plot(time_pulse, E_exp)
legend('Theoretial', 'Experimental', 'Location', 'best')
xlabel("time [s]")
ylabel("E [1/s]")
title("Comparison between E_{exp} and E_{theo}")
hold off
```



For STEP input

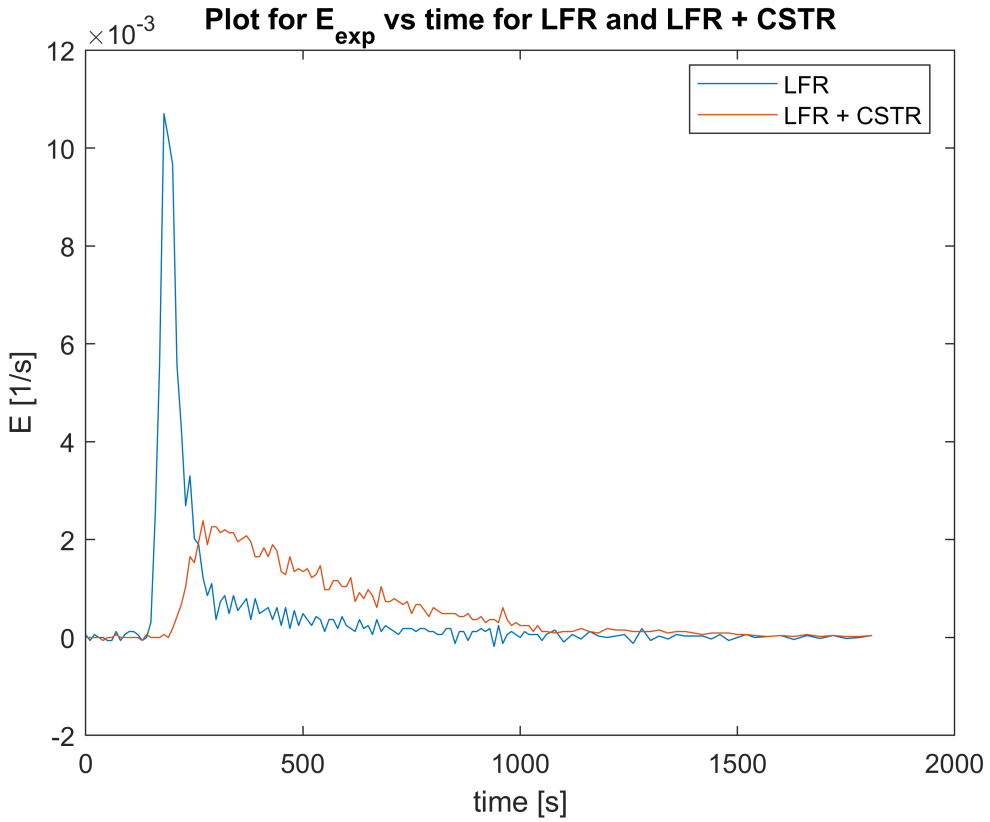
```
C_both=[96    96    96    96    96    95    95    95    96    96    96    96    96    96    95
]; % value from data collected by us
C_LFR=[119    120    119    120    120    120    119    118    120    119    120    122    124
] ;% value from data collected by us
time_step = [0    10    20    30    40    50    60    70    80    90    100    110    120    1
];% the time corresponding to the values,

len = length(time_step);
C_o = C_both(len);
F_exp_L = (C_LFR/C_o)';
E_exp_L = (zeros(1,len-1));
for i = 1:len-1
    E_exp_L(i) = (F_exp_L(i+1) - F_exp_L(i))/(time_step(i+1) - time_step(i));
end
E_exp_L = E_exp_L';
% for F_theo of LFR
F_theo_L = zeros(1,len);
for i = 1:len
    if time_step(i) >= tau/2
        F_theo_L(i) = 1 - (tau*tau)/(4*time_step(i)*time_step(i));
    end
end
F_theo_L=F_theo_L';
```

```
% For LFR + CSTR
F_exp_both = (C_both/C_o)';
E_exp_both = zeros(1,len-1);
for i = 1:len-1
    E_exp_both(i) = (F_exp_both(i+1) - F_exp_both(i))/(time_step(i+1) - time_step(i));
end
E_exp_both=E_exp_both';

% Plotting Concentrations
plot(time_step,C_LFR)
hold on
plot(time_step,C_both)
hold off
xlabel("Time [s]")
ylabel("Concentration (conductivity) [micro siemens]")
legend("LFR", "LFR + CSTR")
title("Concentration vs Time for step input in LFR and LFR + CSTR")
```

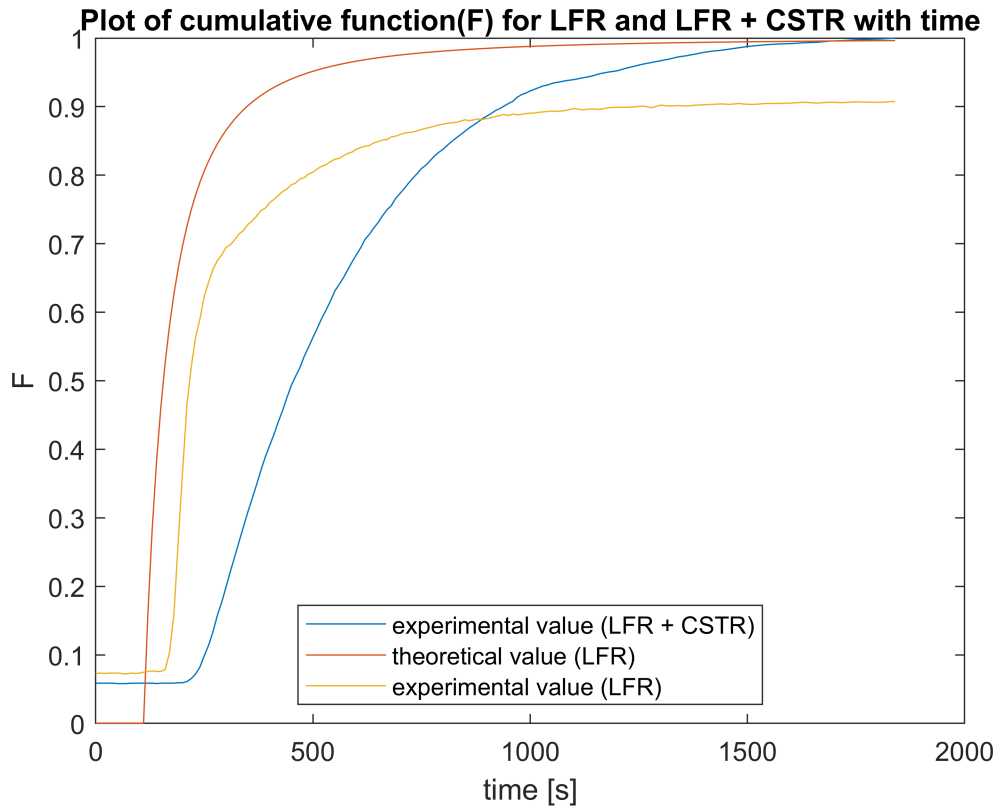



```
% Plotting E and F
plot(time_step(1:len-1),E_exp_L)
hold on
plot(time_step(1:len-1),E_exp_both)
hold off
legend('LFR', 'LFR + CSTR', 'Location', 'best')
xlabel("time [s]")
ylabel("E [1/s]")
```

```
title("Plot for E_{exp} vs time for LFR and LFR + CSTR")
```




```
% Plotting F theo and exp
plot(time_step, F_exp_both)
hold on
plot(time_step, F_theo_L)
plot(time_step, F_exp_L)
hold off
xlabel("time [s]")
ylabel("F")
legend('experimental value (LFR + CSTR)', 'theoretical value (LFR)', 'experimental value (LFR)
title("Plot of cumulative function(F) for LFR and LFR + CSTR with time")
```


Plot of cumulative function(F) for LFR and LFR + CSTR with time
F
time [s]
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
500
1000
1500
2000
experimental value (LFR + CSTR)
theoretical value (LFR)
experimental value (LFR)