Implementation of LMS FIR based Adaptive Filter for System Identification

Under the guidance of :
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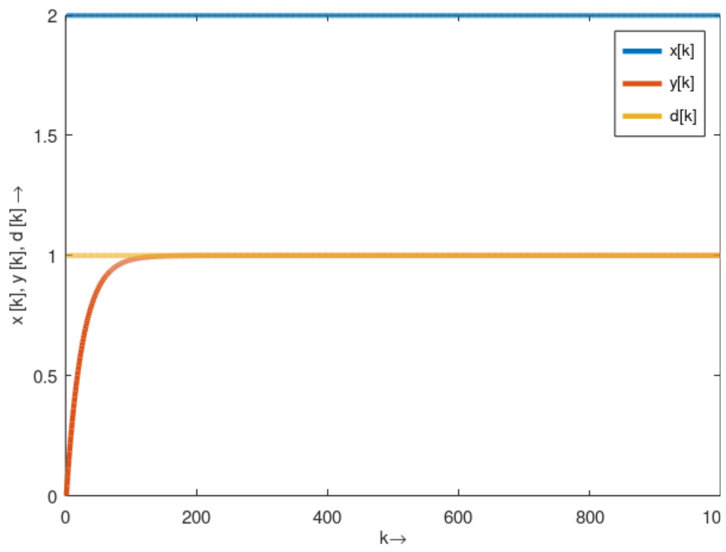
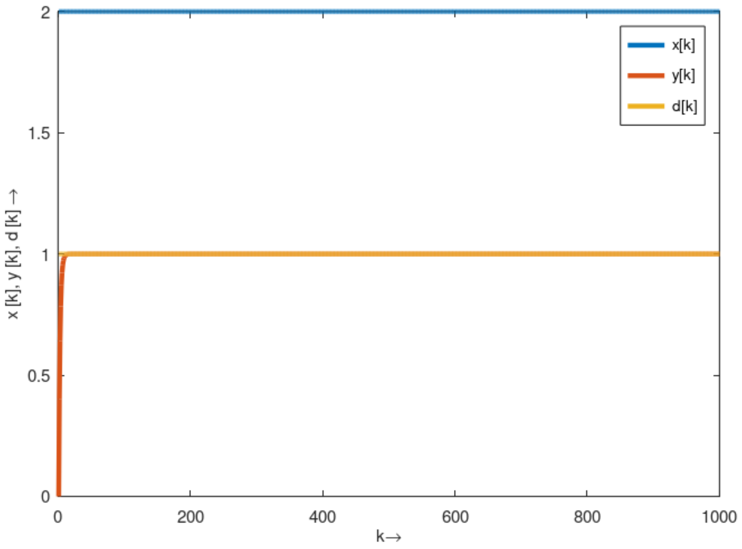
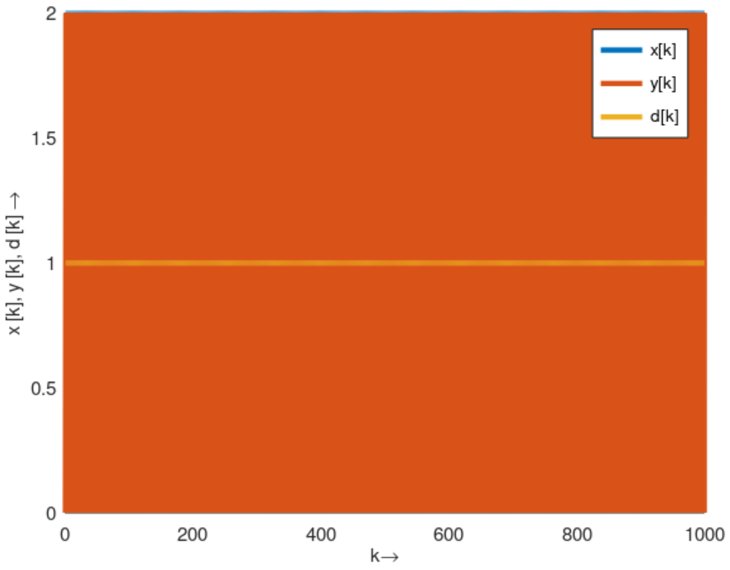


(μ) = 0.01



(μ) = 0.1



(μ) = 0.5

Task 01
LMS Algorithm

Plot x[k], y[k] and d[k] for different step size

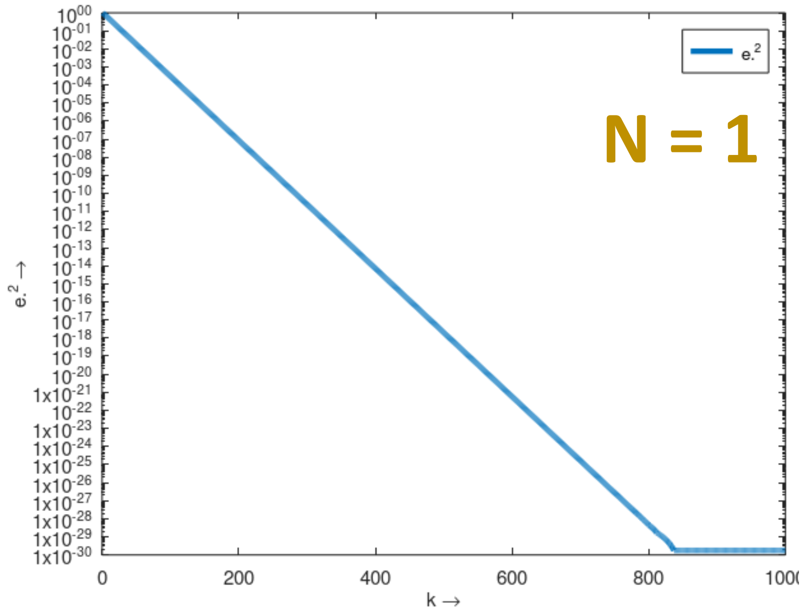
M -> Larger the step size causes a faster convergence but also a larger excess error

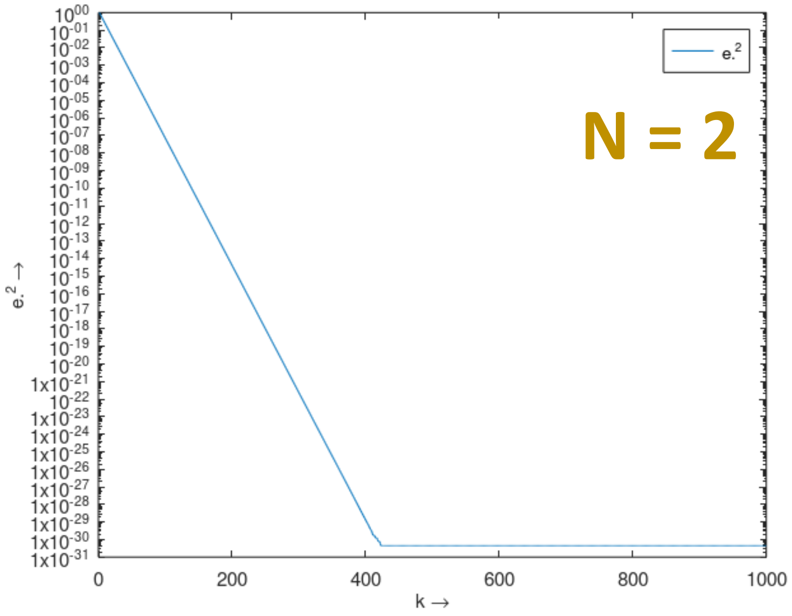
EXCESS ERROR : Wiener solution is approximated and not guaranteed

The convergence speed of LMS algorithm depends on the conditioning X (R) of the input and the step size μ. The LMS algorithm is therefore considered a rather 'slow' algorithm

Task 02
LEARNING CURVE

Compare the Behavior of learning curve for N = 1 and N = 2





J = Jmin + Jex

If N increases, Jmin decreases (accuracy) and Jex (inaccuracy) increases

The number of weights N should therefore be kept as small as possible but large enough to meet the requirements of the applications.

Task 02 :LEARNING CURVE

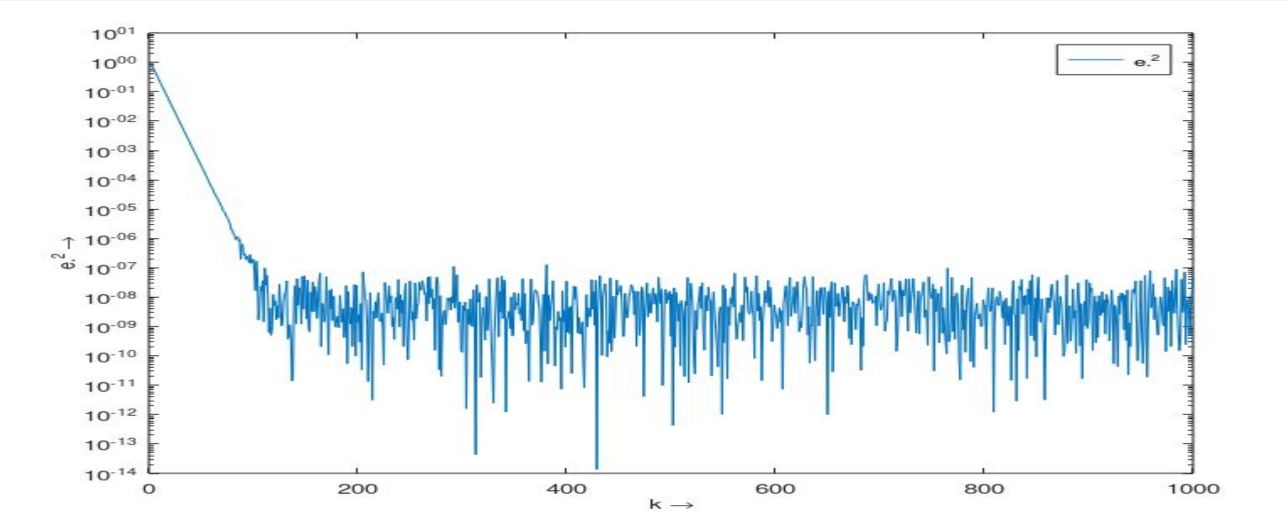
N = 2

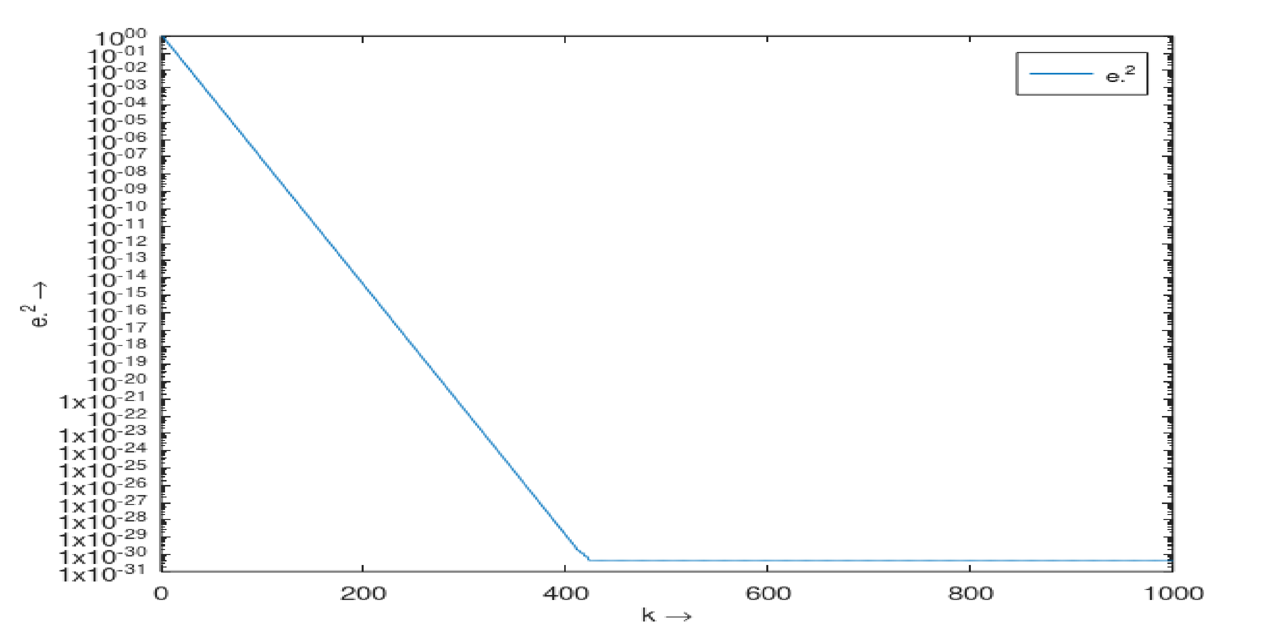
Compare the learning curves with and without noise. ***Do the coefficients converge ?***

YES!

For LMS an excess error Jex[k] > 0 remains for k → ∞ (gradient noise)

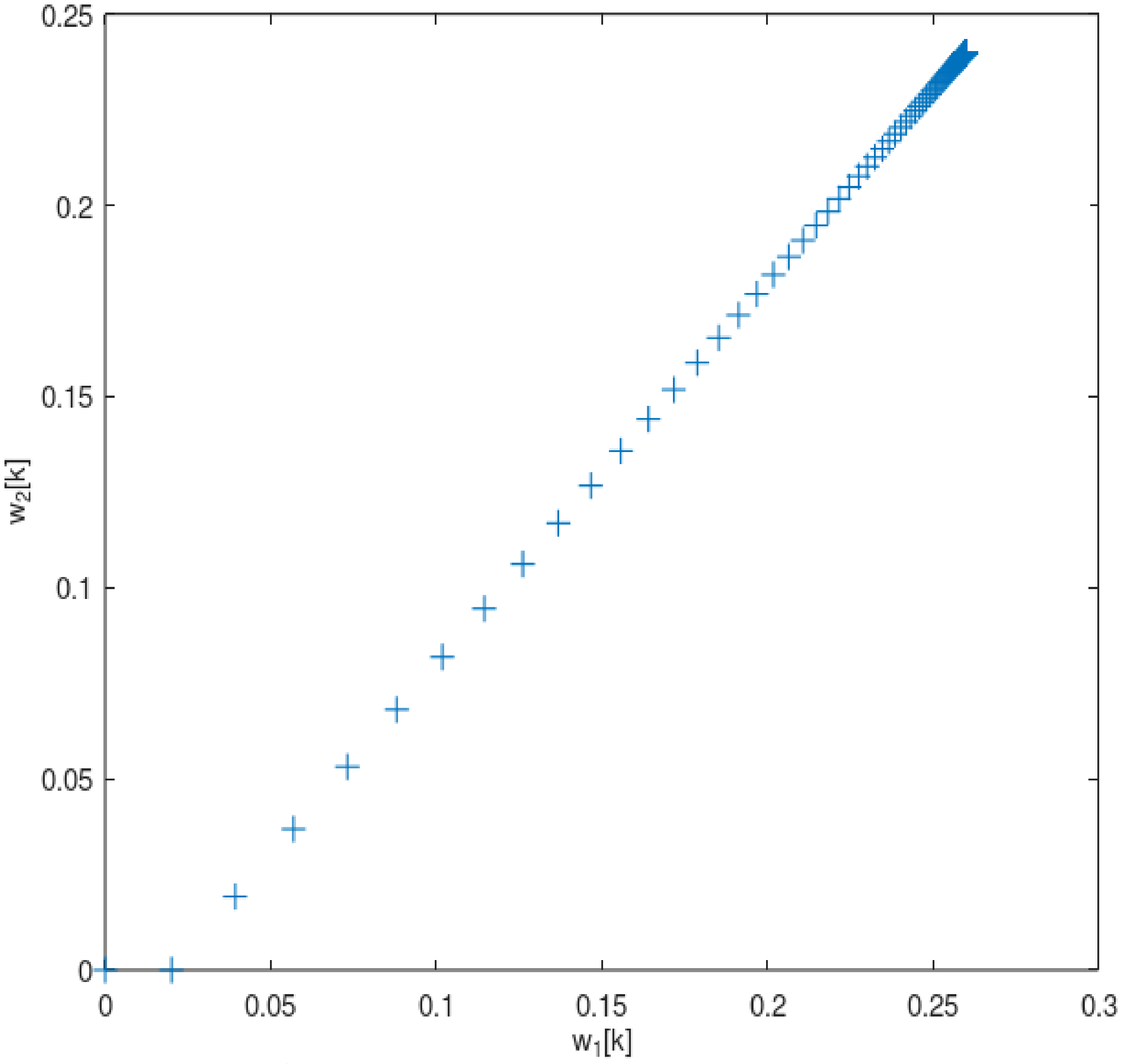
For the LMS algorithm, which is an approximation of the gradient method, we can at most expect to get close to Jmin (gradient noise).





Task 02
Learning Curve

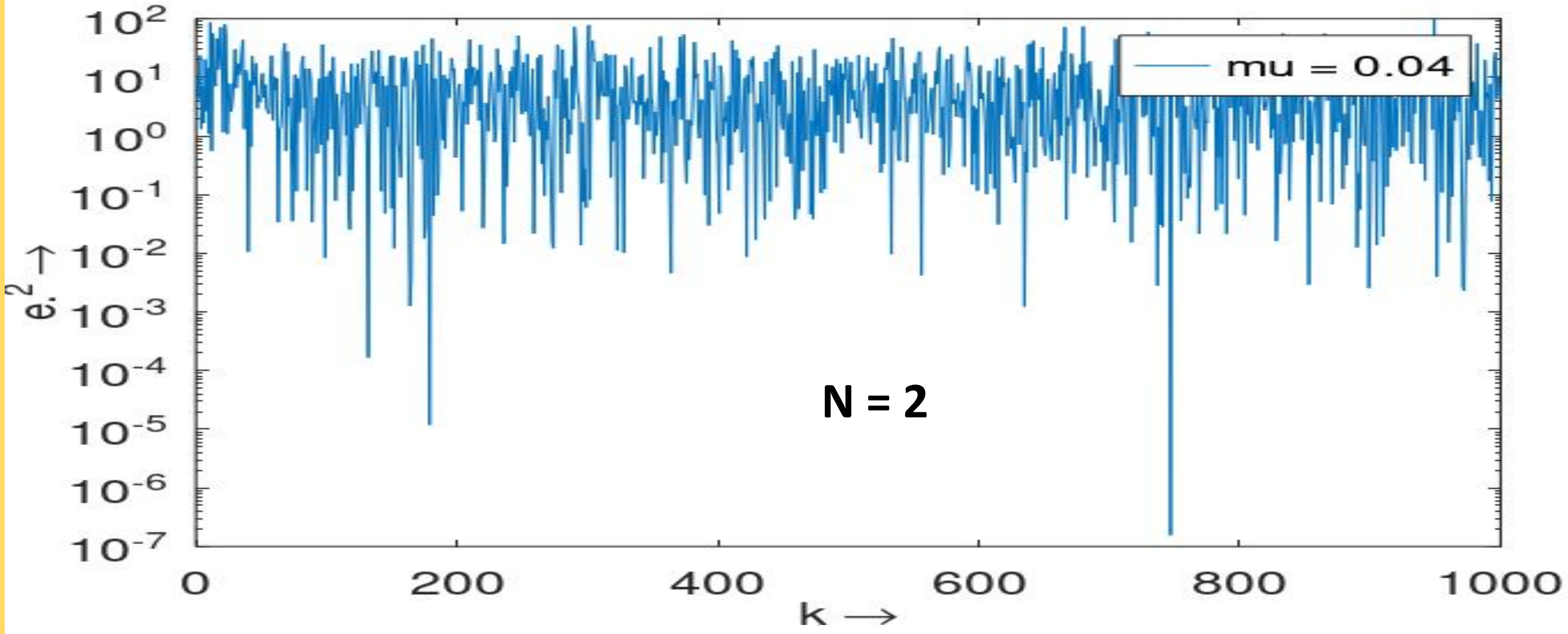
- Filter Vector Coefficients
- w_1 = 0.26
- w_2 = 0.24

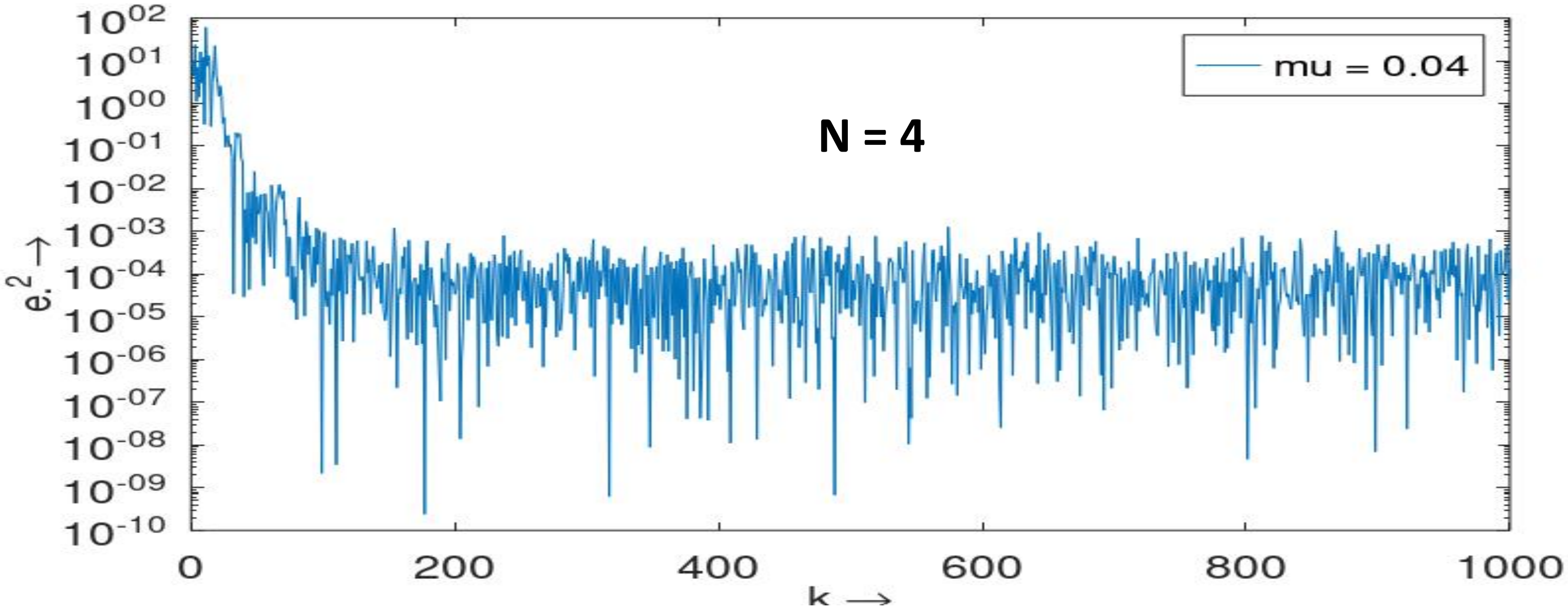


Determine the optimal length N

N should therefore be kept as small as possible but large enough to meet the requirements of the applications.

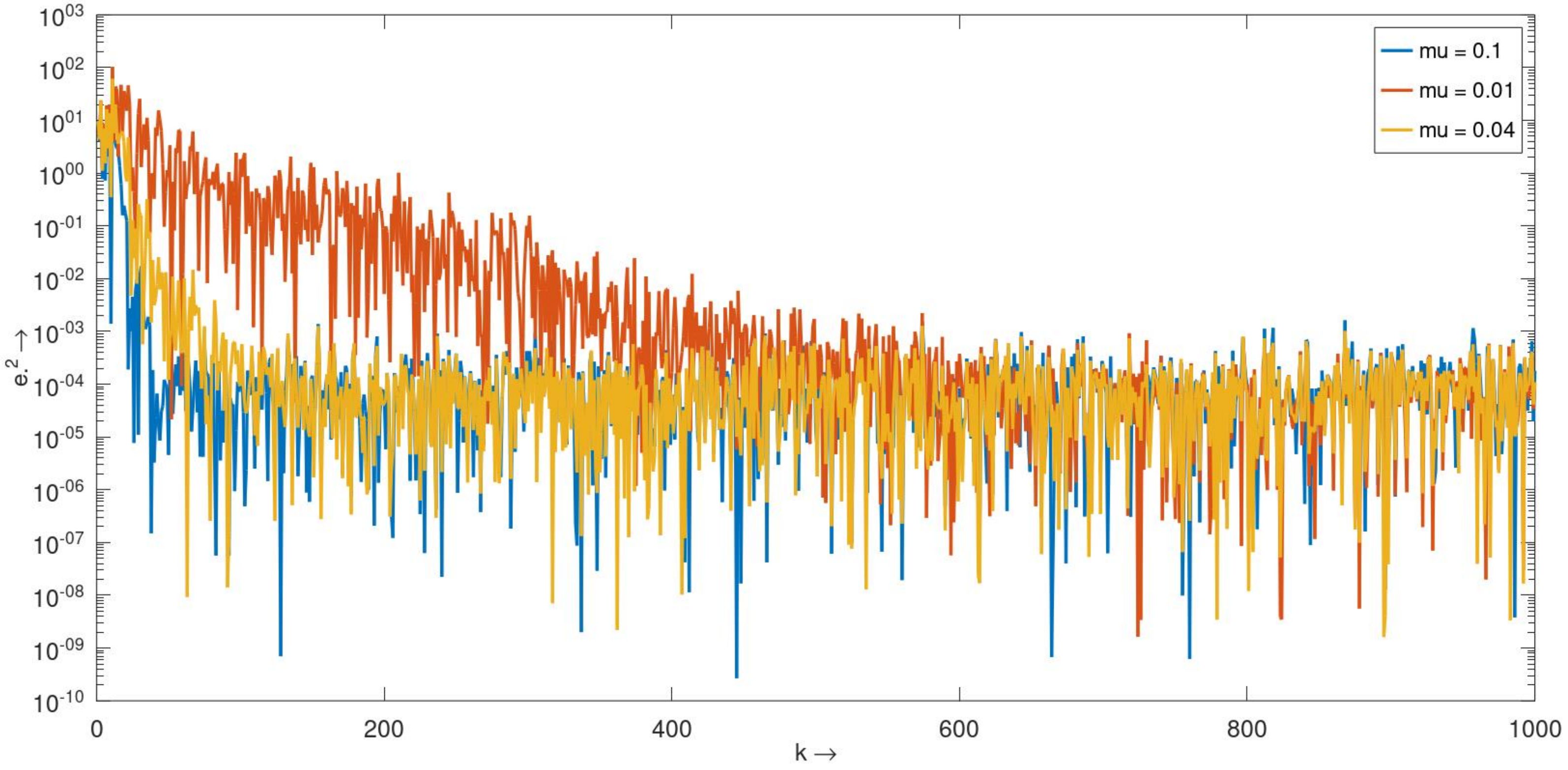
Task 03
System Identification



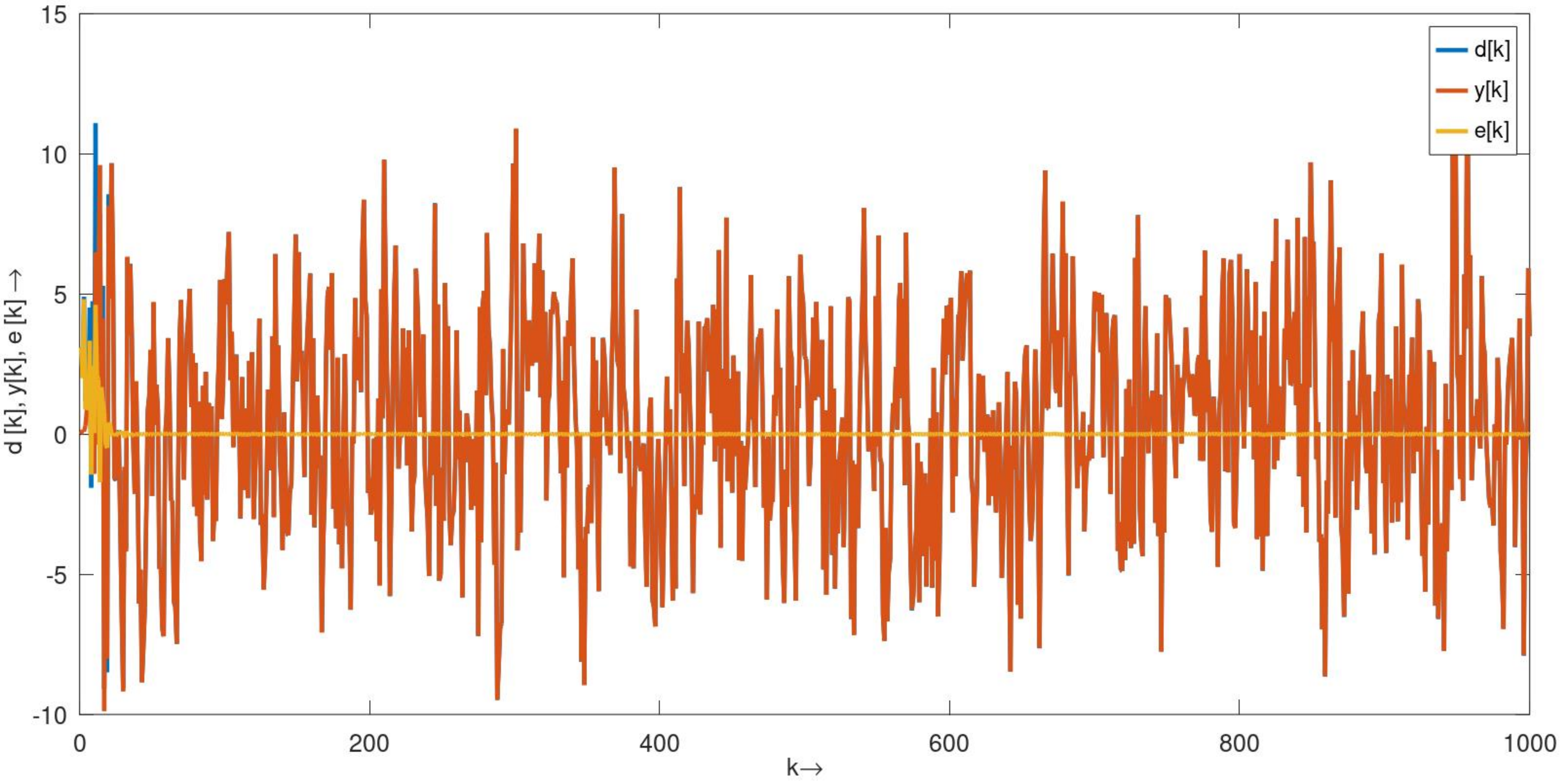


Task 03
System Identification

Determine the optimal step size



Task 3
System Identification



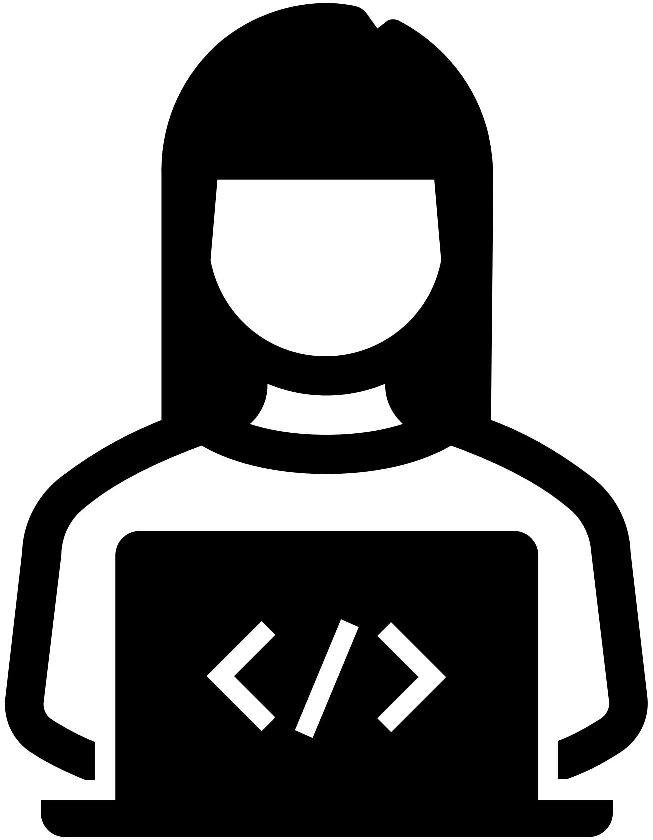
1.9974	1.9970	1.9974	1.9967	1.9975	1.9977	1.9978
1.0016	1.0009	1.0013	1.0019	1.0027	1.0029	1.0025
2.9978	2.9982	2.9989	2.9995	2.9987	2.9990	2.9986
-0.0018	-0.0014	-0.0019	-0.0007	-0.0014	-0.0016	-0.0020

Show the filter coefficients wi, i=1..N,

Round(w) ->

Task 03
System Identification

2	2	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1
3	3	3	3	3	3	3	3	3
0	0	0	0	0	0	0	0	0



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