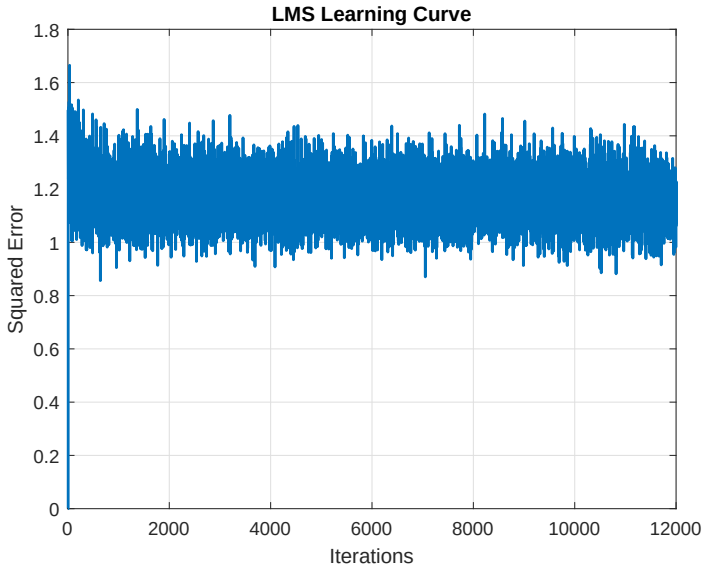
Homework V

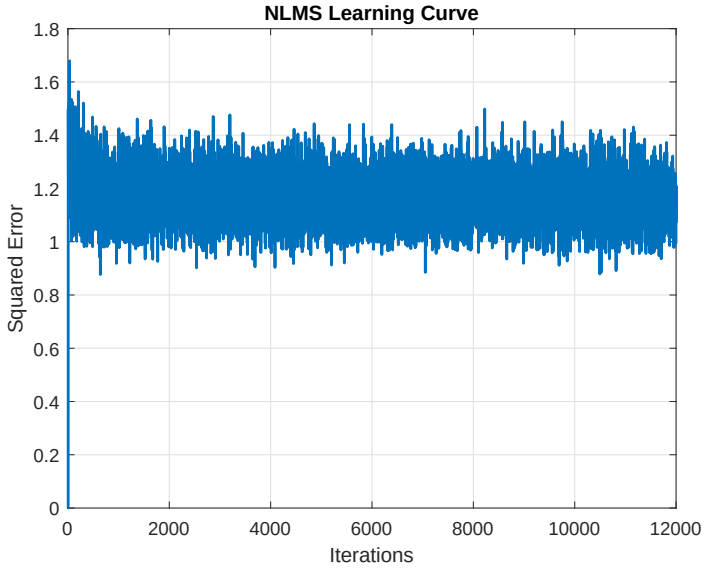
1. Adaptive Interference Canceling

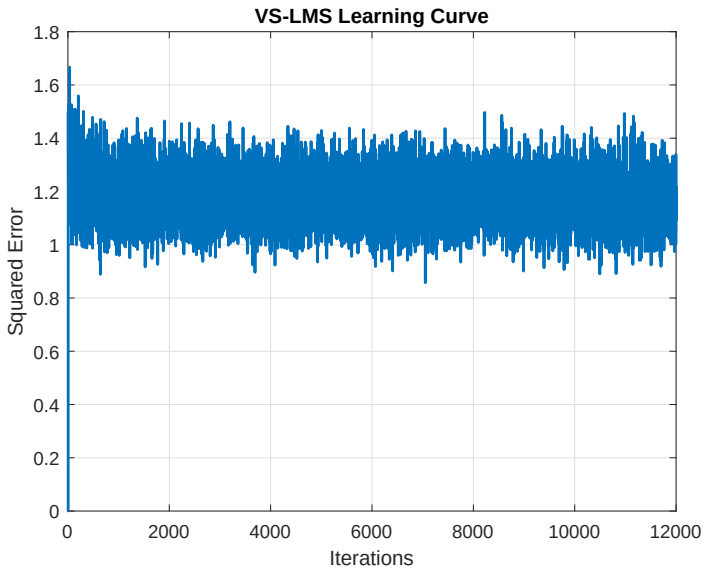
Parameter specifications:

- Step size $\alpha = 10^{-2}$
- Maximum step size $\alpha_{\max} = 10^{-2}$
- Minimum step size $\alpha_{\max} = 10^{-4}$

(a) The learning curves of different algorithms averaging over 100 trials are







(b) The BER of different algorithms averaging over 100 trials are

	BER 1 (iteration = 101 $\sim$ 12000)	BER 2 (iteration = 1001 $\sim$ 12000)
LMS	$4.06 \cdot 10^{-3}$	$3.94 \cdot 10^{-3}$
NLMS	$3.96 \cdot 10^{-3}$	$3.91 \cdot 10^{-3}$
VS-LMS	$3.60 \cdot 10^{-3}$	$3.54 \cdot 10^{-3}$

(C) The average squared error of different algorithms over 100 trials are

	Square Error 1 (iteration = 101 $\sim$ 12000)	Square Error 2 (iteration = 1001 $\sim$ 12000)
LMS	$1.69 \cdot 10^{-1}$	$1.67 \cdot 10^{-1}$
NLMS	$1.68 \cdot 10^{-1}$	$1.65 \cdot 10^{-1}$
VS-LMS	$1.82 \cdot 10^{-1}$	$1.79 \cdot 10^{-1}$

(d) It is seen that the learning curves for three algorithms are vibrated near 1.3. If the performace metric is BER, the ranking of these thre algorithms is

$$\text{VS-LMS} > \text{NLMS} > \text{LMS}.$$

If average squared error is chosen as performace metric, then the ranking is

$$\text{NLMS} > \text{LMS} > \text{VS-LMS}.$$

Moreover, it can be observed that both the BER and squared error from iterations 1001 to 12000 are smaller than those from iterations 101 to 12000. A possible explanation is that the algorithms have not yet converged during the initial iterations.