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reviewer2@nptel.iitm.ac.in ▼

Courses » **Estimation for Wireless Communications – MIMO/OFDM Cellular and Sensor Networks**

Announcements **Course** Ask a Question Progress

Unit 9 - Week 8 - Sequential Least Squares (SLS) Estimation – Scalar/ Vector Cases, Applications - Wireless Fading Channel Estimation, SLS Example

Assignment-8

The due date for submitting this assignment has passed. **Due on 2017-09-18, 23:59 IST.**
As per our records you have not submitted this assignment.

1) Consider an $N = 4$ subcarrier OFDM system with **conventional** channel estimation i.e. pilot symbols transmitted on all the carriers, given as, $X(0) = 3 - j, X(1) = 2 + 3j, X(2) = -1 - 2j, X(3) = -2 + j$. The ISI channel has $L = 2$ taps, denoted by $h(0), h(1)$. Let the corresponding received samples in the time domain be $y(0) = 2 + j, y(1) = 3 + 2j, y(2) = -1 - j, y(3) = 2 - 3j$. Let the noise samples $v(k), 0 \leq k \leq 3$ be zero-mean IID Gaussian with variance σ^2. Also, let the cyclic prefix be of length one symbol. The estimate of the channel coefficient $H(3)$ across subcarrier 3 is, *1 point*

- $\frac{7}{5} - \frac{4}{5}j$
- $\frac{19}{13} - \frac{22}{13}j$
- $\frac{19}{10} + \frac{3}{10}j$
- $\frac{2}{5} - \frac{9}{5}j$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{7}{5} - \frac{4}{5}j$

2) Consider an $N = 4$ subcarrier OFDM system with **comb** type channel estimation and transmitted symbols $X(0) = 3 - j, X(1) = 2 + 3j, X(2) = -1 - 2j, X(3) = -2 + j$. The ISI channel has $L = 2$ taps, denoted by $h(0), h(1)$. Let $l = 0, 3$ denote the pilot subcarriers. Let the corresponding received samples in the time domain be $y(0) = 2 + j, y(1) = 3 + 2j, y(2) = -1 - j, y(3) = 2 - 3j$. Let the noise samples $v(k), 0 \leq k \leq 3$ be zero-mean IID Gaussian with variance σ^2. Also, let the cyclic prefix be of length two symbols. The estimate of the channel tap $h(0)$ is, *1 point*

- $-\frac{22}{10} - \frac{5}{10}j$
-

$\frac{22}{10} + \frac{5}{10}j$

$\frac{22}{10} - \frac{5}{10}j$

$-\frac{22}{10} + \frac{5}{10}j$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{22}{10} - \frac{5}{10}j$

3) Consider a Frequency Domain Equalization system with block length N. Let $Y(l)$ and $H(l)$ denote respectively the output and channel coefficient corresponding subcarrier N. The estimate of the transmitted symbol $x(k)$ is given as, ***1 point***

$\sum_{l=0}^{N-1} \frac{Y(l)}{H(l)} e^{-j2\pi \frac{lk}{N}}$

$\frac{1}{N} \sum_{l=0}^{N-1} \frac{Y(l)}{H(l)} e^{j2\pi \frac{lk}{N}}$

$\frac{1}{N} \sum_{l=0}^{N-1} \frac{H(l)}{Y(l)} e^{j2\pi \frac{lk}{N}}$

$\sum_{l=0}^{N-1} \frac{H(l)}{Y(l)} e^{-j2\pi \frac{lk}{N}}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{N} \sum_{l=0}^{N-1} \frac{Y(l)}{H(l)} e^{j2\pi \frac{lk}{N}}$

4) Consider a sequential fading channel estimation problem where the output symbol $y(k)$ is $y(k) = hx(k) + v(k)$, with $h, x(k), v(k)$ denoting the *real* channel coefficient, pilot symbol and noise sample respectively. Let $\mathbf{x} = [-2 \quad 3 \quad 2]^T$ denote the pilot vector of transmitted pilot symbols at $N = 3$ and $\mathbf{y} = [3 \quad 2 \quad -1]^T$ denote the corresponding received symbol vector at $N = 3$. Let the transmitted and received symbols respectively at $N + 1 = 4$ be $x(4) = -1, y(4) = -2$ respectively. Let $v(k)$ be IID Gaussian noise with zero-mean and dB variance $\sigma^2 = -3dB$. Let $p(N)$ denote the variance at time N. The expression for the gain $K(N + 1)$ at time $N + 1$ is, ***1 point***

$\frac{p(N)x(N+1)}{\sigma^2+p(N)x(N+1)}$

$\frac{p(N)x^2(N+1)}{\sigma^2+p(N)x^2(N+1)}$

$\frac{p(N)x^2(N+1)}{\sigma^2+p(N)x(N+1)}$

$\frac{p(N)x(N+1)}{\sigma^2+p(N)x^2(N+1)}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{p(N)x(N+1)}{\sigma^2+p(N)x^2(N+1)}$

Estimate and Variance Update Equation

Lecture 39 - Example Sequential Estimation of Wireless Channel Coefficient

Quiz : Assignment-8

Assignment-8 Solution

5) Consider a sequential fading channel estimation problem where the output symbol $y(k)$ is $y(k) = hx(k) + v(k)$, with $h, x(k), v(k)$ denoting the *real* channel coefficient, pilot symbol and noise sample respectively. Let $\mathbf{x} = [-2 \quad 3 \quad 2]^T$ denote the pilot vector of transmitted pilot symbols at $N = 3$ and $\mathbf{y} = [3 \quad 2 \quad -1]^T$ denote the corresponding received symbol vector at $N = 3$. Let the transmitted and received symbols respectively at $N + 1 = 4$ be $x(4) = -1, y(4) = -2$ respectively. Let $v(k)$ be IID Gaussian noise with zero-mean and dB variance $\sigma^2 = -3dB$. Let $p(N)$ denote the variance at time N. The gain $K(N+1)$ at time $N + 1 = 4$ is, *1 point*

- $-\frac{1}{16}$
- $-\frac{1}{17}$
- $-\frac{1}{18}$
- $-\frac{1}{19}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$-\frac{1}{18}$

6) Consider a sequential fading channel estimation problem where the output symbol $y(k)$ is $y(k) = hx(k) + v(k)$, with $h, x(k), v(k)$ denoting the *real* channel coefficient, pilot symbol and noise sample respectively. Let $\mathbf{x} = [-2 \quad 3 \quad 2]^T$ denote the pilot vector of transmitted pilot symbols at $N = 3$ and $\mathbf{y} = [3 \quad 2 \quad -1]^T$ denote the corresponding received symbol vector at $N = 3$. Let the transmitted and received symbols respectively at $N + 1 = 4$ be $x(4) = -1, y(4) = -2$ respectively. Let $v(k)$ be IID Gaussian noise with zero-mean and dB variance $\sigma^2 = -3dB$. Let $p(N)$ denote the variance at time N. The prediction error at time $N + 1 = 4$ is, *1 point*

- $-\frac{38}{17}$
- $-\frac{36}{17}$
- $-\frac{34}{17}$
- $-\frac{32}{17}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$-\frac{36}{17}$

7) Consider a sequential fading channel estimation problem where the output symbol $y(k)$ is $y(k) = hx(k) + v(k)$, with $h, x(k), v(k)$ denoting the *real* channel coefficient, pilot symbol and noise sample respectively. Let $\mathbf{x} = [1 \quad -1 \quad 1]^T$ denote the pilot vector of transmitted pilot symbols at $N = 3$ and $\mathbf{y} = [2 \quad \frac{1}{2} \quad \frac{3}{2}]^T$ denote the corresponding received symbol vector at $N = 3$. Let the transmitted and received symbols respectively at $N + 1 = 4$ be $x(4) = -1, y(4) = -1$ respectively. Let $v(k)$ be IID Gaussian noise with zero-mean and dB variance $\sigma^2 = -3dB$. What is the prediction error at time $N + 1 = 4$ is, *1 point*

- 1
-

0

$\frac{1}{2}$

$\frac{1}{4}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
0

8) Consider a sequential fading channel estimation problem where the output symbol $y(k)$ is $y(k) = hx(k) + v(k)$, with $h, x(k), v(k)$ denoting the *real* channel coefficient, pilot symbol and noise sample respectively. Let $\mathbf{x} = [1 \quad -1 \quad 1]^T$ denote t[he] pilot vector of transmitted pilot symbols at $N = 3$ and $\mathbf{y} = [2 \quad \frac{1}{2} \quad \frac{3}{2}]^T$ denote the corresponding received symbol vector at $N = 3$. Let the transmitted and received symbols respectively at $N + 1$ be $x(4) = -1, y(4) = -1$ respectively. Let $v(k)$ be IID Gaussian noise with zero-mean and dB variance $\sigma^2 = -3dB$. The gain $K(4)$ at time $N + 1$ is, *1 po[int]*

0

$\frac{1}{4}$

$-\frac{1}{4}$

$\frac{1}{2}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$-\frac{1}{4}$

9) Consider a sequential fading channel estimation problem where the output symbol $y(k)$ is $y(k) = hx(k) + v(k)$, with $h, x(k), v(k)$ denoting the *real* channel coefficient, pilot symbol and noise sample respectively. Let $\mathbf{x} = [1 \quad -1 \quad 1]^T$ denote the pilot vector of transmitted pilot symbols at $N = 3$ and $\mathbf{y} = [2 \quad \frac{1}{2} \quad \frac{3}{2}]^T$ denote the corresponding received symbol vector at $N = 3$. Let the transmitted and received symbols respectively at $N + 1 = 4$ be $x(4) = -1, y(4) = -1$ respectively. Let $v(k)$ be IID Gaussian noise with zero-mean and dB variance $\sigma^2 = -3dB$. The update i.e. quantity to be added to estimate $\widehat{h}(3)$ at $N = 3$ to generate the estimate $\widehat{h}(4)$ at time $N + 1 = 4$ is, *1 point*

$\frac{1}{2}$

$\frac{1}{3}$

$\frac{1}{4}$

0

No, the answer is incorrect.
Score: 0

Accepted Answers:
0

10) *1 point*

Consider a sequential fading channel estimation problem where the output symbol $y(k)$ is $y(k) = hx(k) + v(k)$, with $h, x(k), v(k)$ denoting the *real* channel coefficient, pilot symbol and noise sample respectively. Let $\mathbf{x} = [1 \quad -1 \quad 1]^T$ denote the pilot vector of transmitted pilot symbols at $N = 3$ and $\mathbf{y} = [2 \quad \frac{1}{2} \quad \frac{3}{2}]^T$ denote the corresponding received symbol vector at $N = 3$. Let the transmitted and received symbols respectively at $N + 1 = 4$ be $x(4) = -1, y(4) = -1$ respectively. Let $v(k)$ be IID Gaussian noise with zero-mean and dB variance $\sigma^2 = -3dB$. The variance of the estimate $\hat{h}(4)$ at time $N + 1 = 4$ is,

- $\frac{1}{4}$
- $\frac{1}{8}$
- $\frac{1}{10}$
- $\frac{1}{16}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{8}$

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