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

Announcements Course Ask a Question Progress

Unit 3 - Week 2 - Vector Estimation

Assignment-2

The due date for submitting this assignment has passed. **Due on 2017-08-06, 23:59 IST.**
As per our records you have not submitted this assignment.

1) Consider the 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 $\mathbf{x} = [x(1), x(2), \ldots, x(N)]^T$ denote the pilot vector of transmitted pilot symbols and $\mathbf{y} = [y(1), y(2), \ldots, y(N)]^T$ denote the corresponding received symbol vector. Let $v(k)$ be IID Gaussian noise with zero-mean and variance σ^2. The expected value of the maximum likelihood $\hat{h}$ is, ***1 point***

- $\mathbf{x}^T\mathbf{y}$
- $\frac{\mathbf{x}^T\mathbf{y}}{\mathbf{x}^T\mathbf{x}}$
- $h\mathbf{x}^T\mathbf{y}$
- h

No, the answer is incorrect.
Score: 0

Accepted Answers:
h

2) Consider the 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 $\mathbf{x} = \left[\frac{3}{2}, 1, \frac{1}{2}, -2\right]^T$ denote the pilot vector of transmitted pilot symbols and $\mathbf{y} = \left[2, -\frac{1}{2}, -1, \frac{3}{2}\right]^T$ denote the corresponding received symbol vector. Let $v(k)$ be IID Gaussian noise with zero-mean and dB variance $\sigma^2 = -3dB$. The maximum likelihood estimate of the channel coefficient h is, ***1 point***

- $\frac{1}{15}$
- $\frac{2}{15}$
- $-\frac{1}{15}$
- $-\frac{2}{15}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$-\frac{2}{15}$

3) Consider the 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 $\mathbf{x} = \left[\frac{3}{2}, 1, \frac{1}{2}, -2\right]^T$ denote the pilot vector of transmitted pilot symbols and $\mathbf{y} = \left[2, -\frac{1}{2}, -1, \frac{3}{2}\right]^T$ denote the corresponding received symbol vector. Let $v(k)$ be IID Gaussian noise with zero-mean and dB variance $\sigma^2 = -3dB$. The variance of the maximum likelihood estimate of the channel coefficient h is, ***1 point***

- $\frac{1}{15}$
- $\frac{2}{15}$
- $\frac{3}{15}$
- $\frac{4}{15}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{15}$

4) Consider the 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 *complex* channel coefficient, pilot symbol and noise sample respectively. Let $\mathbf{x} = [1-2j \quad 2+j \quad 1-j \quad 2-j]^T$ denote the pilot vector of transmitted pilot symbols and $\mathbf{y} = [1-j \quad -1+2j \quad 1 \quad 1-2j]^T$ denote the corresponding received symbol vector. Let $v(k)$ be IID Gaussian noise with zero-mean and dB variance $\sigma^2 = -9dB$. The maximum likelihood estimate of the channel coefficient h is, ***1 point***

- $\frac{6}{17}j$
- $\frac{8}{17} + \frac{4}{17}j$
- $-\frac{4}{17} - \frac{6}{17}j$
- $\frac{8}{17} - \frac{4}{17}j$

No, the answer is incorrect.
Score: 0

Feedback:

Accepted Answers:
$\frac{8}{17} + \frac{4}{17}j$

5) Consider the 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 *complex* channel coefficient, pilot symbol and noise sample respectively. Let $\mathbf{x} = [1-2j \quad 2+j \quad 1-j \quad 2-j]^T$ denote the pilot vector of transmitted pilot symbols and $\mathbf{y} = [1-j \quad -1+2j \quad 1 \quad 1-2j]^T$ denote the corresponding received symbol vector. Let $v(k)$ be IID Gaussian noise with zero-mean and dB variance ***1 point***

Cases, Applications - Wireless Fading Channel Estimation, SLS Example

$\sigma^2 = -9dB$. The variance of the maximum likelihood estimate of the channel coefficient h is,

- $\frac{1}{120}$
- $\frac{1}{136}$
- $\frac{1}{150}$
- $\frac{1}{196}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{136}$

6) Consider the 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 *complex* channel coefficient, pilot symbol and noise sample respectively. Let $\mathbf{x} = [1-2j \quad 2+j \quad 1-j \quad 2-j]^T$ denote the pilot vector of transmitted pilot symbols and $\mathbf{y} = [1-j \quad -1+2j \quad 1 \quad 1-2j]^T$ denote the corresponding received symbol vector. Let $v(k)$ be IID Gaussian noise with zero-mean and dB variance $\sigma^2 = -9dB$. The variance of the real part of the maximum likelihood $\hat{h}$ is, *1 point*

- $\frac{1}{240}$
- $\frac{1}{196}$
- $\frac{1}{272}$
- $\frac{1}{75}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{272}$

7) Consider the 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 *complex* channel coefficient, pilot symbol and noise sample respectively. Let $\mathbf{x} = [1-2j \quad 2+j \quad 1-j \quad 2-j]^T$ denote the pilot vector of transmitted pilot symbols and $\mathbf{y} = [1-j \quad -1+2j \quad 1 \quad 1-2j]^T$ denote the corresponding received symbol vector. Let $v(k)$ be IID Gaussian noise with zero-mean and dB variance $\sigma^2 = -9dB$. The variance of the imaginary part of the maximum likelihood $\hat{h}$ is, *1 point*

- $\frac{1}{272}$
- $\frac{1}{300}$
- $\frac{1}{75}$
- $\frac{1}{392}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{272}$

8) Consider the 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 *complex* channel coefficient, pilot symbol and noise sample respectively. Let $\mathbf{x} = [1-2j \quad 2+j \quad 1-j \quad 2-j]^T$ denote the pilot vector of transmitted pilot symbols and $\mathbf{y} = [1-j \quad -1+2j \quad 1 \quad 1-2j]^T$ denote the corresponding received symbol vector. Let $v(k)$ be IID Gaussian noise with zero-mean and dB varianc $\sigma^2 = -9dB$. The errors in the real and imaginary parts of the maximum likelihood $\hat{h}$ are *1 point*

- Equal
- Correlated
- Independent
- All of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
Independent

9) Consider the 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 $\mathbf{x} = [x(1), x(2), \ldots, x(N)]^T$ denote the pilot vector of transmitted pilot symbols and $\mathbf{y} = [y(1), y(2), \ldots, y(N)]^T$ denote the corresponding received symbol vector. Let $v(k)$ be independent Gaussian noise with zero-mean and variance $k\sigma^2$. And let $\mathbf{R}$ denote the covariance matrix of the noise vector $\mathbf{v} = [v(1), v(2), \ldots, v(N)]^T$. The ML estimate of the channel coefficient is, *1 point*

- $\hat{h} = \frac{1}{N}\sum_{k=1}^{N}\frac{y(k)}{k}$
- $\frac{\mathbf{x}^T\mathbf{y}}{\mathbf{x}^T\mathbf{x}}$
- $x^T\mathbf{R}^{-1}y$
- $\hat{h} = \frac{\sum_{k=1}^{N}\frac{x(k)y(k)}{k}}{\sum_{k=1}^{N}\frac{x^2(k)}{k}}$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$$\hat{h} = \frac{\sum_{k=1}^{N}\frac{x(k)y(k)}{k}}{\sum_{k=1}^{N}\frac{x^2(k)}{k}}$$

10) Consider the 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 $\mathbf{x} = [x(1), x(2), \ldots, x(N)]^T$ denote the pilot vector of transmitted pilot symbols and $\mathbf{y} = [y(1), y(2), \ldots, y(N)]^T$ denote the corresponding received symbol vector. Let $v(k)$ be independent Gaussian noise with zero-mean and variance $k\sigma^2$. And let $\mathbf{R}$ denote the covariance matrix of the noise vector *1 point*

$\mathbf{v} = [v(1), v(2), \ldots, v(N)]^T$. The variance of the ML estimate of the channel coefficient is,

- $\dfrac{\sigma^2}{\|x^2\|}$
- $\dfrac{1}{x^T \mathbf{R}^{-1} x}$
- $\dfrac{\sigma^2}{\sum_{k=1}^{N} k|x(k)|^2}$
- $\dfrac{\sigma^2}{N}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\dfrac{1}{x^T \mathbf{R}^{-1} x}$

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