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

Announcements **Course** Ask a Question Progress

Unit 8 - Week 7 - OFDM – Comb Type Pilot (CTP) Transmission, Channel Estimation in Time/ Frequency Domain, CTP Example, Frequency Domain Equalization (FDE), Example-FDE

Course outline

Assignment - 7

The due date for submitting this assignment has passed. Due on 2017-09-11, 23:59 IST.
As per our records you have not submitted this assignment.

1) Consider an $N = 4$ subcarrier OFDM system with $L = 2$ channel taps denoted by $h(0), h(1)$. **Conventional** channel estimation is employed with the pilot symbols transmitted on all the subcarriers given as $X(0) = 1 - j, X(1) = -1 + 2j, X(2) = -2 - j, X(3) = 1 + j$. Let the corresponding received samples in the time domain be $y(0) = -1 + j, y(1) = 2 - j, y(2) = 2 + 2j, y(3) = -1 - j$. 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 transmitted block of samples in the time domain is, *1 point*

- $1 - j, -1 + 2j, -2 - j, 1 + j$
- $-\frac{1}{4} + \frac{1}{4}j, \frac{1}{2} - \frac{1}{2}j, -\frac{1}{4} - \frac{5}{4}j, 1 + \frac{1}{2}j$
- $1 + \frac{1}{2}j, -\frac{1}{4} + \frac{1}{4}j, \frac{1}{2} - \frac{1}{2}j, -\frac{1}{4} - \frac{5}{4}j, 1 + \frac{1}{2}j$
- $1 + j, 1 - j, -1 + 2j, -2 - j, 1 + j$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$1 + \frac{1}{2}j, -\frac{1}{4} + \frac{1}{4}j, \frac{1}{2} - \frac{1}{2}j, -\frac{1}{4} - \frac{5}{4}j, 1 + \frac{1}{2}j$

2) Consider an $N = 4$ subcarrier OFDM system with $L = 2$ channel taps denoted by $h(0), h(1)$. **Conventional** channel estimation is employed with the pilot symbols transmitted on all the subcarriers given as $X(0) = 1 - j, X(1) = -1 + 2j, X(2) = -2 - j, X(3) = 1 + j$. Let the corresponding received samples in the time domain be $y(0) = -1 + j, y(1) = 2 - j, y(2) = 2 + 2j, y(3) = -1 - j$. 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 action of the channel on the transmitted block of OFDM samples can be modeled as, *1 point*

- Linear convolution in Time
- Multiplication in Time

- Circular Convolution in Time
- Circular Convolution in Frequency

No, the answer is incorrect.
Score: 0

Accepted Answers:
Circular Convolution in Time

3) Consider an $N = 4$ subcarrier OFDM system with $L = 2$ channel taps denoted by $h(0), h(1)$. **Conventional** channel estimation is employed with the pilot symbols transmitted on all the subcarriers given as $X(0) = 1 - j, X(1) = -1 + 2j, X(2) = -2 - j, X(3) = 1 + j$. Let the corresponding received samples in the time domain be $y(0) = -1 + j, y(1) = 2 - j, y(2) = 2 + 2j, y(3) = -1 - j$. 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 noise samples $V(l)$ on the l^{th} subcarrier are, *1 point*

- Zero-mean, Gaussian, variance σ^2
- Zero-mean, Non-Gaussian, variance σ^2
- Zero-mean, Gaussian, variance $\frac{\sigma^2}{4}$
- None of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
None of the above

4) Consider an $N = 4$ subcarrier OFDM system with $L = 2$ channel taps denoted by $h(0), h(1)$. **Conventional** channel estimation is employed with the pilot symbols transmitted on all the subcarriers given as $X(0) = 1 - j, X(1) = -1 + 2j, X(2) = -2 - j, X(3) = 1 + j$. Let the corresponding received samples in the time domain be $y(0) = -1 + j, y(1) = 2 - j, y(2) = 2 + 2j, y(3) = -1 - j$. 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 received symbols across the subcarriers are *1 point*

- $1 - j, -2 + j, 1 - j, 1 + 2j$
- $2 + j, -3 - 4j, 5j, -3 + 2j$
- $-1 + j, 2 - j, 2 + 2j, -1 - j$
- $2 + j, -3 - j, 1 + 3j, -1 - j$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$2 + j, -3 - 4j, 5j, -3 + 2j$

5) Consider an $N = 4$ subcarrier OFDM system with $L = 2$ channel taps denoted by $h(0), h(1)$. **Conventional** channel estimation is employed with the pilot symbols transmitted on all the subcarriers given as $X(0) = 1 - j, X(1) = -1 + 2j, X(2) = -2 - j, X(3) = 1 + j$. Let the corresponding received samples in the time domain be $y(0) = -1 + j, y(1) = 2 - j, y(2) = 2 + 2j, y(3) = -1 - j$. Let the noise samples $v(k), 0 \leq k \leq 3$ be zero-mean IID Gaussian with variance σ^2. Also, let the *1 point*

Estimation – Scalar/ Vector Cases, Applications - Wireless Fading Channel Estimation, SLS Example

cyclic prefix be of length one symbol. The estimate of the channel coefficient $H(1)$ across subcarrier 1 is,

- $-1 + 2j$
- $\frac{1}{2} + \frac{3}{2}j$
- $-\frac{4}{5} - \frac{3}{5}j$
- $1 - 2j$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$-1 + 2j$

6) Consider an $N = 4$ subcarrier OFDM system with $L = 2$ channel taps denoted by $h(0), h(1)$. **Comb** type channel estimation is employed with the transmitted symbols on the subcarriers given as $X(0) = 1 - j, X(1) = -1 + 2j, X(2) = -2 - j, X(3) = 1 + j$. Let the pilot subcarriers be $l = 0, 2$. Let the corresponding received samples in the time domain be $y(0) = -1 + j, y(1) = 2 - j, y(2) = 2 + 2j, y(3) = -1 - j$. 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 channel coefficient $H(1)$ across subcarrier 1 is, *1 point*

- $1 - \frac{1}{2}j$
- $-2 + j$
- $-1 - 2j$
- $\frac{3}{2} - j$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{3}{2} - j$

7) Consider an $N = 4$ subcarrier OFDM system with $L = 2$ channel taps denoted by $h(0), h(1)$. **Comb** type channel estimation is employed with the transmitted symbols on the subcarriers given as $X(0) = 1 - j, X(1) = -1 + 2j, X(2) = -2 - j, X(3) = 1 + j$. Let the pilot subcarriers be $l = 0, 2$. Let the corresponding received samples in the time domain be $y(0) = -1 + j, y(1) = 2 - j, y(2) = 2 + 2j, y(3) = -1 - j$. 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 channel coefficient $H(2)$ across subcarrier 2 is, *1 point*

- $\frac{3}{2} + \frac{1}{2}j$
- $2 - j$
- $-1 - 2j$
- $\frac{1}{2} + \frac{3}{2}j$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$-1-2j$

8) 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 transmitted block of samples in the time domain is, *1 point*

- $\frac{3}{4} - \frac{3}{2}j \quad \frac{1}{4} - \frac{1}{2}j \quad \frac{5}{4} - \frac{1}{2}j \quad -\frac{7}{4} - \frac{1}{2}j \quad \frac{3}{4} - \frac{3}{2}j$
- $2 - 5j \quad 2 - j \quad 6 + 3j \quad 2 + 7j \quad 2 - 5j$
- $\frac{3}{2} - \frac{3}{4}j \quad \frac{1}{2} + \frac{1}{4}j \quad \frac{1}{2} + \frac{5}{4}j \quad \frac{1}{2} - \frac{7}{4}j \quad \frac{3}{2} - \frac{3}{4}j$
- $2 + 5j \quad 2 + j \quad 6 - 3j \quad 2 - 7j \quad 2 + 5j$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{3}{2} - \frac{3}{4}j \quad \frac{1}{2} + \frac{1}{4}j \quad \frac{1}{2} + \frac{5}{4}j \quad \frac{1}{2} - \frac{7}{4}j \quad \frac{3}{2} - \frac{3}{4}j$

9) 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 symbols received across the subcarriers in the frequency domain are, *1 point*

- $6 - j \quad 8 + j \quad -4 + j \quad 2 - 3j$
- $6 - j \quad 8 + j \quad -4 + j \quad -2 + 3j$
- $6 - j \quad 8 + j \quad 4 - j \quad -2 + 3j$
- $6 - j \quad -8 - j \quad -4 + j \quad -2 + 3j$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$6 - j \quad 8 + j \quad -4 + j \quad -2 + 3j$

10) 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 $H(2)$ across subcarrier 2 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:
$\frac{2}{5} - \frac{9}{5}j$

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