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

Announcements **Course** Ask a Question Progress

# Unit 7 - Week 6 - Introduction to Orthogonal Frequency Division Multiplexing (OFDM) and Pilot Based OFDM Channel Estimation, Example

## Course outline



## Assignment - 6

**The due date for submitting this assignment has passed. Due on 2017-09-04, 23:59 IST.**
**As per our records you have not submitted this assignment.**

1) Consider an Inter Symbol Interference channel $y(k) = x(k) + \frac{1}{3}x(k-1) + v(k)$. Let an $r = 2$ tap channel equalizer be designed for this scenario based on symbols $y(k), y(k+1)$ to detect $x(k)$. Let the equalizer vector be denoted by $\mathbf{c}$. The least squares problem for estimation of $\mathbf{c}$ is, *1 point*

- $$\left\| \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} - \begin{bmatrix} 1 & 0 \\ \frac{1}{3} & 1 \\ 0 & \frac{1}{3} \end{bmatrix} \mathbf{c} \right\|^2$$
- $$\left\| \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} - \begin{bmatrix} 1 & 0 \\ \frac{1}{3} & 1 \\ 0 & \frac{1}{3} \end{bmatrix} \mathbf{c} \right\|^2$$
- $$\left\| \begin{bmatrix} 0 \\ 1 \end{bmatrix} - \begin{bmatrix} \frac{1}{3} & 1 & 0 \\ 0 & \frac{1}{3} & 1 \end{bmatrix} \mathbf{c} \right\|^2$$
- $$\left\| \begin{bmatrix} 0 \\ 1 \end{bmatrix} - \begin{bmatrix} 1 & \frac{1}{3} \\ 1 & \frac{1}{3} \end{bmatrix} \mathbf{c} \right\|^2$$

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**

$$\left\| \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} - \begin{bmatrix} 1 & 0 \\ \frac{1}{3} & 1 \\ 0 & \frac{1}{3} \end{bmatrix} \mathbf{c} \right\|^2$$

2) Consider an Inter Symbol Interference channel $y(k) = x(k) + \frac{1}{3}x(k-1) + v(k)$. Let an $r = 2$ tap channel equalizer be designed for this scenario based on symbols $y(k), y(k+1)$ to detect $x(k)$. Let the equalizer vector be denoted by $\mathbf{c}$. The zero-forcing (ZF) equalizer vector $\mathbf{c}$ is, *1 point*

- $\frac{1}{3}\begin{bmatrix}1\\1\end{bmatrix}$
- $\frac{1}{91}\begin{bmatrix}23\\11\end{bmatrix}$
- $\frac{1}{3}\begin{bmatrix}9\\13\end{bmatrix}$
- $\frac{3}{91}\begin{bmatrix}1\\27\end{bmatrix}$

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
$\frac{3}{91}\begin{bmatrix}1\\27\end{bmatrix}$

3) Consider an Inter Symbol Interference channel $y(k) = x(k) + \frac{1}{3}x(k-1) + v(k)$. Let an $r = 2$ tap channel equalizer be designed for this scenario based on symbols $y(k), y(k+1)$ to detect $x(k)$. Let the equalizer vector be denoted by $\mathbf{c}$. The zero-forcing equalizer is, ***1 point***

- $\hat{x}(k) = \frac{1}{3}y(k+1) + \frac{1}{3}y(k)$
- $\hat{x}(k) = \frac{11}{91}y(k+1) + \frac{23}{91}y(k)$
- $\hat{x}(k) = 3y(k+1) + \frac{13}{3}y(k)$
- $\hat{x}(k) = \frac{3}{91}y(k+1) + \frac{81}{91}y(k)$

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
$\hat{x}(k) = \frac{3}{91}y(k+1) + \frac{81}{91}y(k)$

4) Consider an Inter Symbol Interference channel $y(k) = x(k) + \frac{1}{3}x(k-1) + v(k)$. Let an $r = 2$ tap channel equalizer be designed for this scenario based on symbols $y(k), y(k+1)$ to detect $x(k)$. Let the equalizer vector be denoted by $\mathbf{c}$. Let the effective channel matrix for this scenario be denoted by $\mathbf{H}$. The approximation error for the zero-forcing equalizer (counting elements starting with 0) is, ***1 point***

- $1 - \left[\mathbf{H}^T\left(\mathbf{H}\mathbf{H}^T\right)^{-1}\mathbf{H}\right]_{1,1}$
- $1 - \left[\mathbf{H}^T\left(\mathbf{H}\mathbf{H}^T\right)^{-1}\mathbf{H}\right]_{2,2}$
- $1 - \left[\left(\mathbf{H}\mathbf{H}^T\right)^{-1}\right]_{1,1}$
- $1 - \left[\left(\mathbf{H}\mathbf{H}^T\right)^{-1}\right]_{1,1}$

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**

$1-\left[\mathbf{H}^T\left(\mathbf{H}\mathbf{H}^T\right)^{-1}\mathbf{H}\right]_{1,1}$

5) Consider an Inter Symbol Interference channel $y(k)=x(k)+\frac{1}{3}x(k-1)+v(k)$. Let an $r=2$ tap channel equalizer be designed for this scenario based on symbols $y(k), y(k+1)$ to detect $x(k)$. Let the equalizer vector be denoted by $\mathbf{c}$. The approximation error for the zero-forcing equalizer is, *1 point*

- $\frac{1}{3}$
- $\frac{5}{91}$
- $\frac{9}{91}$
- $\frac{27}{91}$

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**

$\frac{9}{91}$

6) Consider an Inter Symbol Interference channel $y(k)=\frac{3}{4}x(k)-\frac{1}{4}x(k-1)+v(k)$. Let an $r=2$ tap channel equalizer be designed for this scenario based on symbols $y(k+1), y(k)$ to detect $x(k)$. What is the effective channel matrix $\mathbf{H}$ for this scenario? *1 point*

- $\mathbf{H}=\begin{bmatrix}\frac{3}{4} & -\frac{1}{4}\\ -\frac{1}{4} & \frac{3}{4}\end{bmatrix}$
- $\mathbf{H}=\begin{bmatrix}\frac{3}{4} & -\frac{1}{4} & 0\\ 0 & \frac{3}{4} & -\frac{1}{4}\end{bmatrix}$
- $\mathbf{H}=\begin{bmatrix}\frac{3}{4} & -\frac{1}{4} & 0 & 0\\ 0 & \frac{3}{4} & -\frac{1}{4} & 0\\ 0 & 0 & \frac{3}{4} & -\frac{1}{4}\end{bmatrix}$
- $\mathbf{H}=\begin{bmatrix}0 & 0 & \frac{3}{4} & -\frac{1}{4}\\ 0 & \frac{3}{4} & -\frac{1}{4} & 0\\ \frac{3}{4} & -\frac{1}{4} & 0 & 0\end{bmatrix}$

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**

$$\mathbf{H} = \begin{bmatrix} \frac{3}{4} & -\frac{1}{4} & 0 \\ 0 & \frac{3}{4} & -\frac{1}{4} \end{bmatrix}$$

7) Consider an Inter Symbol Interference channel $y(k) = \frac{3}{4}x(k) - \frac{1}{4}x(k-1) + v(k)$. Let an $r = 2$ tap channel equalizer be designed for this scenario based on symbols $y(k+1), y(k)$ to detect $x(k)$. Let the effective channel matrix $\mathbf{H}$ for this scenario. The equalizer is, **1 point**

- $\hat{x}(k) = -\frac{4}{91}y(k+1) - \frac{108}{91}y(k)$
- $\hat{x}(k) = \frac{4}{91}y(k+1) + \frac{108}{91}y(k)$
- $\hat{x}(k) = \frac{4}{91}y(k+1) - \frac{108}{91}y(k)$
- $\hat{x}(k) = -\frac{4}{91}y(k+1) + \frac{108}{91}y(k)$

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
$\hat{x}(k) = -\frac{4}{91}y(k+1) + \frac{108}{91}y(k)$

8) Consider an Inter Symbol Interference channel $y(k) = \frac{3}{4}x(k) - \frac{1}{4}x(k-1) + v(k)$. Let an $r = 2$ tap channel equalizer be designed for this scenario based on symbols $y(k+1), y(k)$ to detect $x(k)$. Let the effective channel matrix $\mathbf{H}$ for this scenario. The approximation error is, **1 point**

- $\frac{9}{91}$
- $\frac{10}{91}$
- $\frac{11}{91}$
- $\frac{12}{91}$

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
$\frac{9}{91}$

9) Consider an Inter Symbol Interference channel $y(k) = \frac{3}{4}x(k) - \frac{1}{4}x(k-1) + v(k)$. Let an $r = 2$ tap channel equalizer be designed for this scenario based on symbols $y(k+1), y(k)$ to detect $x(k+1)$. Let the effective channel matrix $\mathbf{H}$ for this scenario. The approximation error is, **1 point**

- $\frac{4}{91}$
- $\frac{3}{91}$
- $\frac{2}{91}$
- $\frac{1}{91}$

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
$\frac{1}{91}$

10) OFDM is a technology which is used in *1 point*

- 4G LTE
- 4G WiMAX
- WiFi
- All of the above

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*All of the above*

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