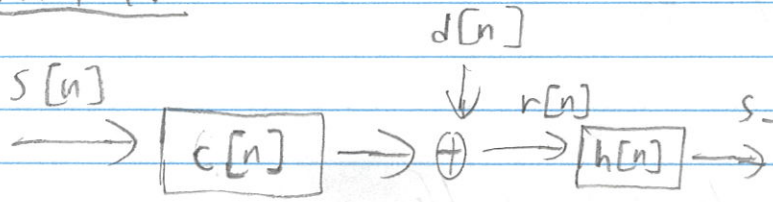
Danny Hong, Arthur Shok, Kenny Huang
ECE 302 Project 5: FIR-MMSE

Part 1:



$R_{yy}[n] = R_{ss}[n] * R_{cc}[n]$ $\quad R_{rr}[n] = R_{yy}[n] + R_{dd}[n]$

$R_{rr}[n] = R_{dd}[n] + R_{ss}[n] * R_{cc}[n]$

$\therefore R_{dd} = 0$ for when $n \neq 0$

$\therefore R_{rr}[n] = R_{ss}[n] * R_{cc}[n] = \overline{R_{cc}}[n]$

$R_{ss}[n]$ is an impulse

$\therefore \overline{R_{cc}}[n] = \sum_{n=-\infty}^{\infty} c[n+m]\,c[n]$

$R_{rs}[n] = c[n] * R_{ss}[n] = c[n]$

$\rightarrow R_{sr}[n] = c[-n]$

$$\begin{bmatrix} R_{rr}[0] & R_{rr}[-1] & R_{rr}[-2] & R_{rr}[-3] \\ R_{rr}[1] & R_{rr}[0] & R_{rr}[-1] & R_{rr}[-2] \\ R_{rr}[2] & R_{rr}[1] & R_{rr}[0] & R_{rr}[-1] \\ R_{rr}[3] & R_{rr}[2] & R_{rr}[1] & R_{rr}[0] \end{bmatrix} \begin{bmatrix} h[0] \\ h[1] \\ h[2] \\ h[3] \end{bmatrix} = \begin{bmatrix} \hat{R_{sr}}[0] \\ \hat{R_{sr}}[1] \\ \hat{R_{sr}}[2] \\ \hat{R_{sr}}[3] \end{bmatrix}$$

$\hat{R_{sr}} = R_{sr}$

$$\begin{bmatrix} 1.2 & 0.28 & 0.4 & 0 \\ 0.28 & 1.2 & 0.28 & 0.4 \\ 0.4 & 0.28 & 1.2 & 0.28 \\ 0 & 0.4 & 0.28 & 1.2 \end{bmatrix} \begin{bmatrix} h[0] \\ h[1] \\ h[2] \\ h[3] \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$\rightarrow \quad h = \begin{bmatrix} 0.99 \\ -0.20 \\ -0.31 \\ 0.14 \end{bmatrix}$$