EECS 16A ## 11.14 LECTURE 22

Superposition! $\vec{r} = \vec{s}_A + \vec{s}_B + \vec{n}$ ← noise

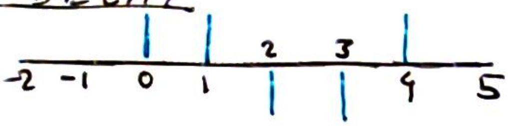
$\langle \vec{r}, \vec{s}_A \rangle = \langle \vec{s}_A + \vec{s}_B + \vec{n}, \vec{s}_A \rangle = (\vec{s}_A^T + \vec{s}_B^T + \vec{n}^T)\vec{s}_A$

$\underbrace{\langle \vec{s}_A, \vec{s}_A \rangle}_{\text{ideally large}} + \underbrace{\langle \vec{s}_B, \vec{s}_A \rangle}_{\text{ideally small}} + \underbrace{\langle \vec{n}, \vec{s}_A \rangle}_{\text{usually small}}$

$\langle \vec{r}, \vec{s}_A \rangle \approx \langle \vec{s}_A, \vec{s}_A \rangle$

ESTIMATING DELAY

$\vec{s}_A = \begin{bmatrix} 1 \\ 1 \\ -1 \\ -1 \\ 1 \end{bmatrix}$



receiver

$r[n] = s[n-3]$

$s[-1] = 0$ $s[4] = 1$

$s[0] = 1$ $s[5] = 0$

$s[n]$ is called signal

$r[0] = 0$ $r[7] = 1$

$r[3] = 1$ $r[8] = 0$

↳ $s[0]$ ↳ $s[4]$

CORRELATION

DEF $\quad \text{corr}_r(s_A)(k) = \sum_{-\infty}^{\infty} r[i]\, s_A[i-k]$

ex. $\quad \text{corr}_r(s_A)(0) = \sum_{-\infty}^{\infty} r[i]\, s_A[i] = r(3)s(3) + r(4)s(4) + \quad r(7)s(7)$

$= 1 \cdot -1 + 1 \cdot 1 + (-1) \cdot 0 + (-1) \cdot 0 + 1 \cdot 0$

$= -1 + 1 = 0$

ex. $\quad \text{corr}(1) = r(3)s(2) + r(4)s(3) + \ldots r(7)s(6) = -3$

ex. $\quad \text{corr}(3) = r(3)s(0) + r(4)s(1) + \ldots r(7)s(4) = 5$