

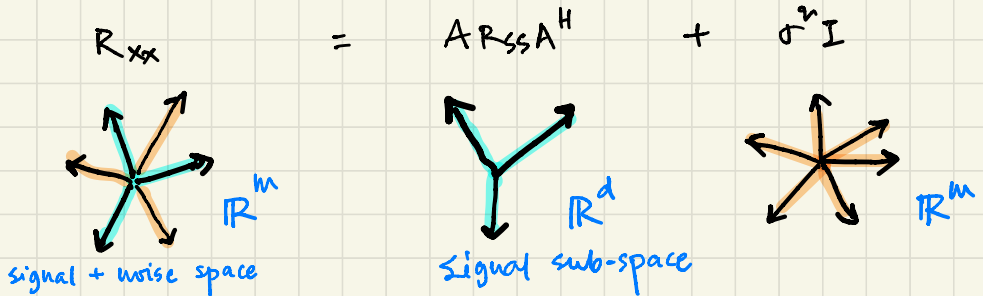
⑤ sub-space based AoA : MUSIC algorithm

$$Y = A\bar{s} + \bar{n}$$

$$\begin{aligned} YY^H &= (As + n)(As + n)^H \\ &= (As + n)(s^H A^H + n^H) \\ &= As s^H A^H + As \cdot n^H + n s^H A^H + nn^H \end{aligned}$$

$$\begin{aligned} E[YY^H] &= E[As s^H A^H + As \cdot n^H + n s^H A^H + nn^H] \\ \underbrace{R_{YY}} &= \underbrace{AR_{ss}A^H} + 0 + 0 + \underbrace{\sigma^2 I} \end{aligned}$$

⑤ Intuition :

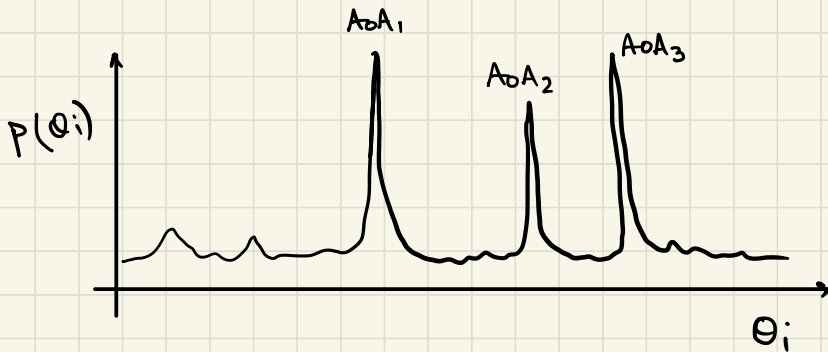


$$\begin{aligned} (R_{xx} - \sigma^2 I) \bar{e}_{d+1} &= 0 \\ &= \underbrace{AR_{ss}A^H}_{\text{Both full rank}} \cdot \bar{e}_{d+1} \\ \therefore A^H \cdot \bar{e}_{d+1} &= 0 \end{aligned}$$

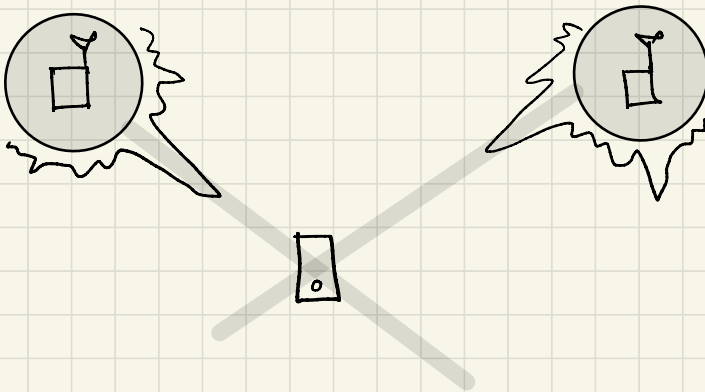
AoA spectrum $P(\theta_i) = \frac{1}{\|A_{\theta_i}^H e_{\text{noise}}\|_{L_1}}$

$1 \times m$ $m \times (m-d)$

$$[-A_{\theta_i}] \begin{bmatrix} | & \dots & | \\ e_{d+1} & & e_m \\ | & & | \end{bmatrix} = [\dots\dots]$$



→ WiFi :



→ But what happens with multipath ?

- LOS path varies while multipath varies
- Identify LOS by observing AoA spectrum peak.
- Apply (MLE) for localization