

(*) All users @ same rate

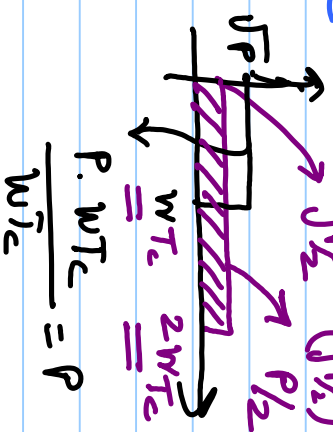
DS-SSMA Uplink

$I_1(k) \leftarrow$ bit

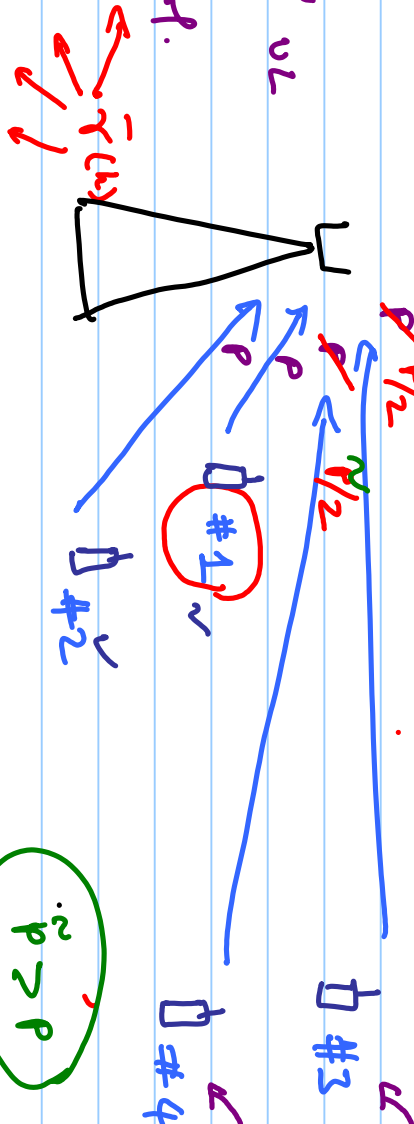
$c_1 \leftarrow$ code

PW_Tc

$$\frac{T}{T_c} = W \quad ; \quad \sqrt{2} \quad (\sqrt{2}) \times 2W T_c$$



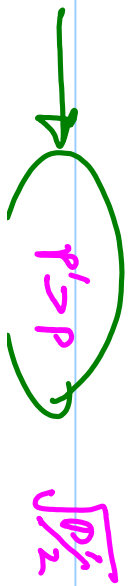
(*) " Perfect " UL power control.



SINR $i \in \{1, 2, 3, 4\}$

$$i = \frac{W \cdot P}{3P + \sigma^2}$$

"symmetric"



Recap:

$c_i \rightarrow$ PU codes

$$k^T \begin{matrix} \overline{w}^T c \\ \overline{w}^T c_1 \end{matrix} \overline{r}(k) = \underbrace{\sqrt{P} I_1(k) \overline{c}_1}_{\text{variance}} + \underbrace{\sqrt{P} I_2(k) \overline{c}_2}_{\text{variance}} + \underbrace{\sqrt{P} I_3(k) \overline{c}_3}_{\text{variance}} + \underbrace{\sqrt{P} I_4(k) \overline{c}_4}_{\text{variance}} + \underbrace{\sqrt{P} I_5(k) \overline{c}_5}_{\text{variance}} + \dots$$

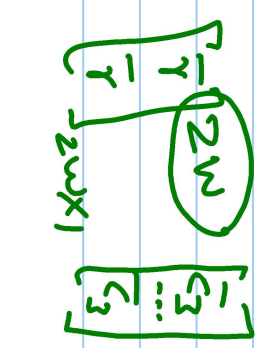
x_1 for user #1

$$\text{SINR}_1 = \frac{WP}{P + \frac{P}{2} + \frac{P}{2} + \sigma^2} = \frac{WP}{2P + \sigma^2}$$

3-user system where all are at same rate !!

(*) For user #3 \star (Assume user #4 does not exist)

$$\overline{c}_3^T \overline{r}(k) \rightarrow \underbrace{PW}_{\text{var.}} + \underbrace{PW}_{\text{var.}} + \sqrt{\frac{P}{2}} W v + \underbrace{W \sigma^2}_{\text{var.}} + \underbrace{\frac{P}{2} W}_{\text{var.}}$$



$$\vec{c}_3^T \vec{x}(kT) \rightarrow \sqrt{P} \vec{w} + P \vec{w} + \sqrt{\frac{P}{2}} \vec{w} + \vec{w} \sigma^2$$

$$\text{SINR}_3 = \frac{(2\sqrt{\frac{P}{2}} \vec{w})^2}{2P \vec{w} + 2P \vec{w} + 2N\sigma^2} = \frac{P \vec{w}}{2P + \sigma^2}$$

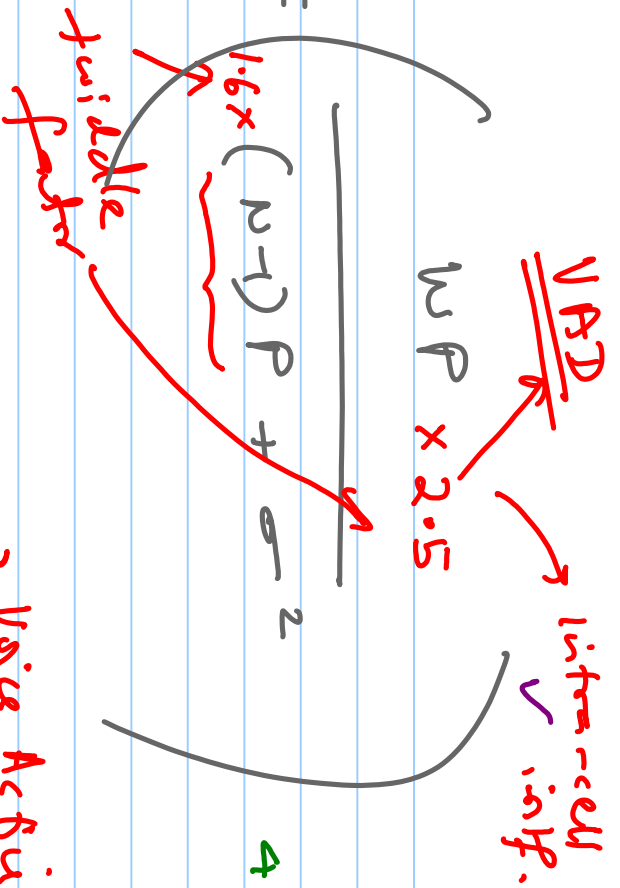
(*) Now, assume user 4 exists, with rate $R/2$ i.e. $\sqrt{\frac{P}{2}}$ amplitude

$$\text{SINR}_3 = \frac{(2\sqrt{\frac{P}{2}} \vec{w})^2}{2P \vec{w} + 2P \vec{w} + \frac{P}{2} \vec{w} + \frac{P}{2} \vec{w} + 2N\sigma^2} = \frac{P \vec{w}}{(2.5)P + \sigma^2}$$

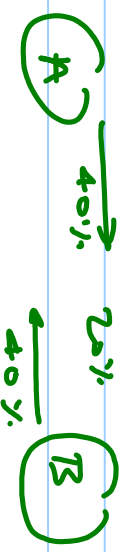
Recall $\text{SINR}_1 = \frac{P \vec{w}}{2P + \sigma^2}$

$N \rightarrow$ # users

SIR =



\rightarrow Voice Activity Defects



$P \rightarrow P/2$

