Problem Formulation

优化问题

$$\min_{\mathbf{q}_n,\mathbf{W}_c,\mathbf{w}_r,\forall n} \frac{a^2+\beta^2}{\left(a\beta-\gamma^2\right)^2}$$

$$s.t. \quad \frac{\left|\mathbf{h}_{c,n}^H\mathbf{w}_n\right|^2}{\sum_{i=1,i\neq n}^{N}\left|\mathbf{h}_{c,n}^H\mathbf{w}_i\right|^2+\sigma_{c,n}^2} \geq \gamma_n, \forall n$$

$$\left\|\mathbf{W}_c\right\|_2^2+\left\|\mathbf{w}_r\right\|_2^2 \leq P_t$$

$$\left|R_n-R_t\right| \leq L_n, \forall n$$

$$R_n+R_t \geq L_n, \forall n$$

Where

$\gamma_n, \sigma_{c,n}, P_t, R_t, \kappa, K_r, \beta_0, N_T, N$ 均为常数

n=1,...,N

$\mathbf{w}_n, \mathbf{w}_r \in C^{N_t\times 1}$

$\mathbf{W}_c \triangleq [\mathbf{w}_1,\cdots,\mathbf{w}_N] \in C^{N_t\times N}$

$$a=\frac{1}{N}\sum_{n=1}^{N}\left(\left(\sum_{m=1}^{N}\frac{\left\|\mathbf{w}_m\right\|_2^2}{\kappa^2R_m^2}\right)\cos^2\theta_n\right)$$

$$\beta=\frac{1}{N}\sum_{n=1}^{N}\left(\left(\sum_{m=1}^{N}\frac{\left\|\mathbf{w}_m\right\|_2^2}{\kappa^2R_m^2}\right)\sin^2\theta_n\right)$$

$$\gamma=\frac{1}{N}\sum_{n=1}^{N}\left(\left(\sum_{m=1}^{N}\frac{\left\|\mathbf{w}_m\right\|_2^2}{\kappa^2R_m^2}\right)\sin\theta_n\cos\theta_n\right)$$

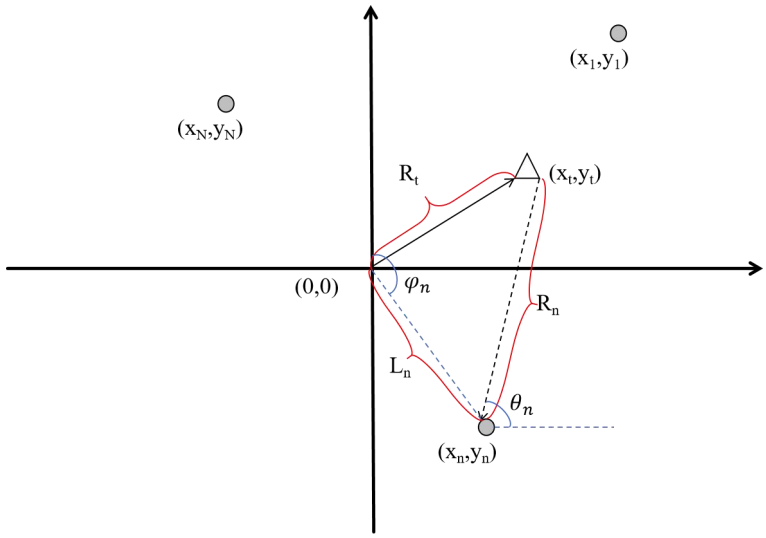
$$\mathbf{h}_{c,n}=\frac{\beta_0}{L_n}\left(\sqrt{\frac{K_r}{K_r+1}}\mathbf{h}_{c,n}^{LoS}+\sqrt{\frac{1}{K_r+1}}\mathbf{h}_{c,n}^{NLoS}\right)\in C^{1\times N_t}$$

$$\mathbf{h}_{c,n}^{LoS}=\left[1 \quad -j\pi\sin\varphi_n \quad ... \quad -j\pi(N_t-1)\sin\varphi_n\right]^H$$

$\mathbf{h}_{c,n}^{NLoS}$ 是一个循环对称复高斯随机变量。

$\mathbf{q}_n=(x_n,y_n)$ 表示坐标，相关的几何量如下图

$\mathbf{q}_t=(x_t,y_t)$ 已知


(x_1,y_1)
(x_N,y_N)
R_t
(x_t,y_t)
(0,0)
φ_n
R_n
L_n
θ_n
(x_n,y_n)