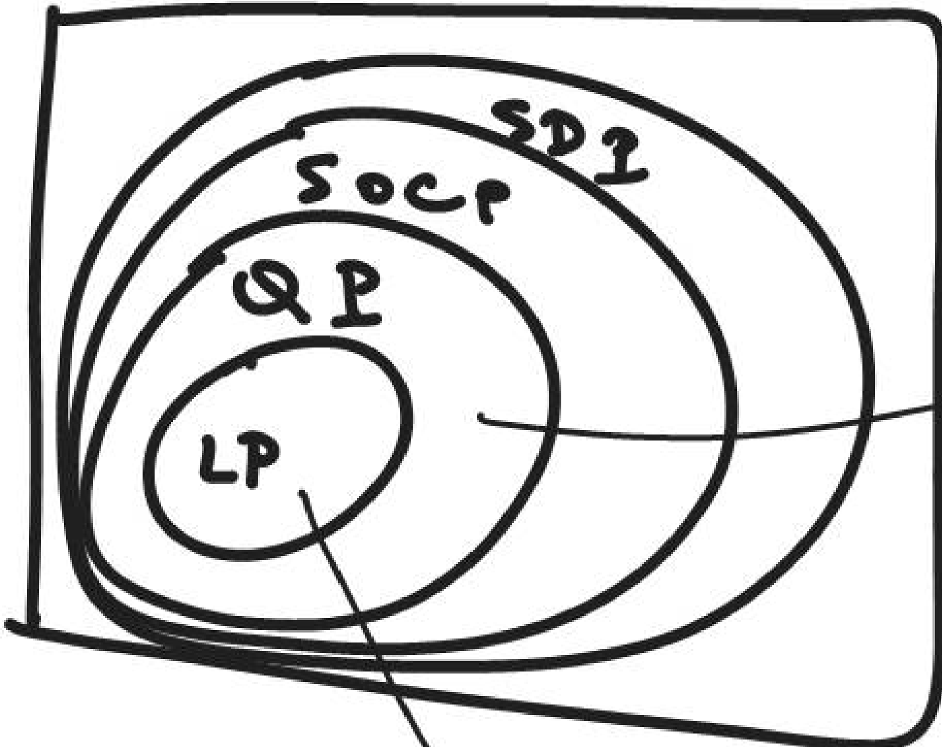
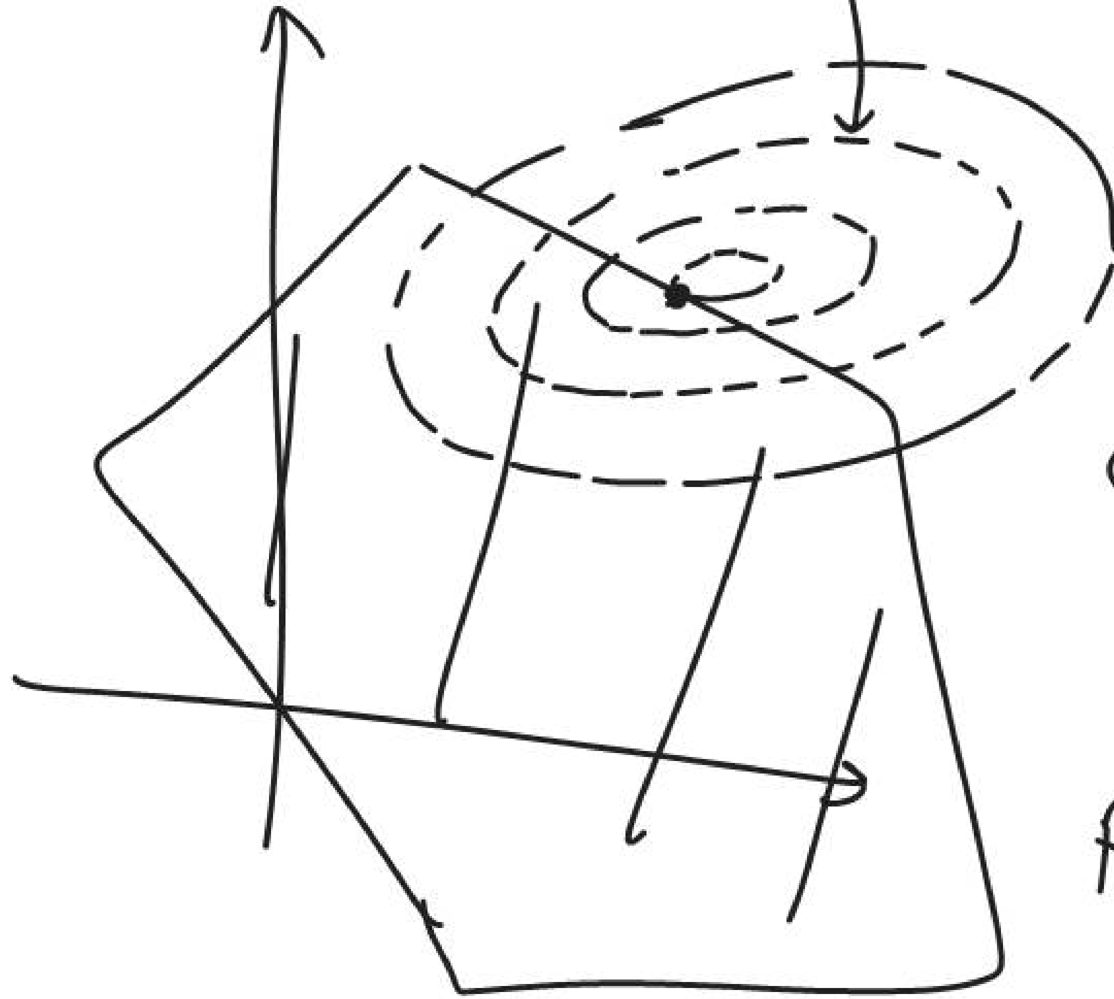


$G \succeq 0$

$$\min.\ c^T x + \frac{1}{2} x^T G x$$
$$\text{s.t. } Ax \le b$$

$$\min.\ c^T x$$
$$\text{s.t. } Ax \le b$$

$\{x : f(x) = r\}$



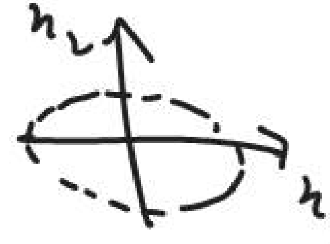
$$\min. \ \overbrace{c^T x + \frac{1}{2} x^T C_1 x}^{f(x)}$$

$$\text{s.t. } Ax \le b$$

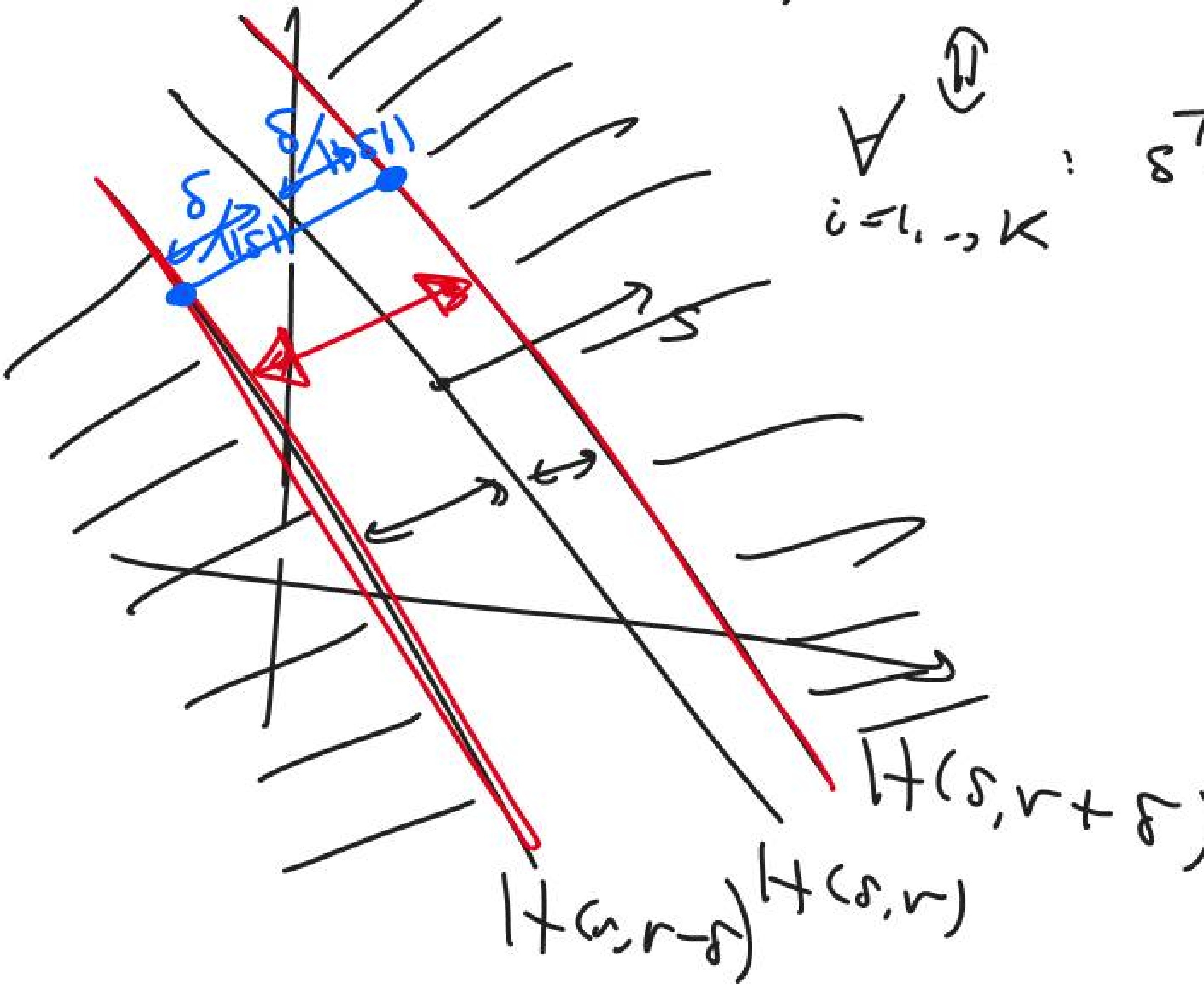
$$C_1 = \begin{bmatrix} c_1 & 0 \\ 0 & c_2 \end{bmatrix} \succeq 0$$

$c = 0$

$$f(x) = r \Leftrightarrow c_1 x_1^2 + c_2 x_2^2 = 2r$$



$$\mathcal{H} \subset H(s, r+\delta)^+$$
$$\Updownarrow$$
$$\forall_{i=1,\dots,K} : s^T x \geq r + \delta$$



$$\max.\ 2\frac{\delta}{\|s\|}$$

$$2\frac{\delta'}{\|s'\|} \leq 2\frac{1}{\|s'/\delta'\|}$$

$(s, r, 1) \leftarrow (s, r)$ ✓

s.t. $s^T x_k \geq r + \delta \quad \forall k$

$s^T y_\ell \leq r - \delta \quad \forall \ell$

$\delta \geq 0$

var: (s, r, δ)

$(s', r', \delta') \rightarrow \left(s'/\delta', r'/\delta'\right)$

$$\frac{s'}{\delta'}^T x_k \geq \frac{r'}{\delta'} + 1$$

$$\max.\ 2\frac{1}{\|s\|}$$

s.t. $s^T x_k \geq r + 1$

$s^T y_\ell \leq r - 1$

var: (s, r)

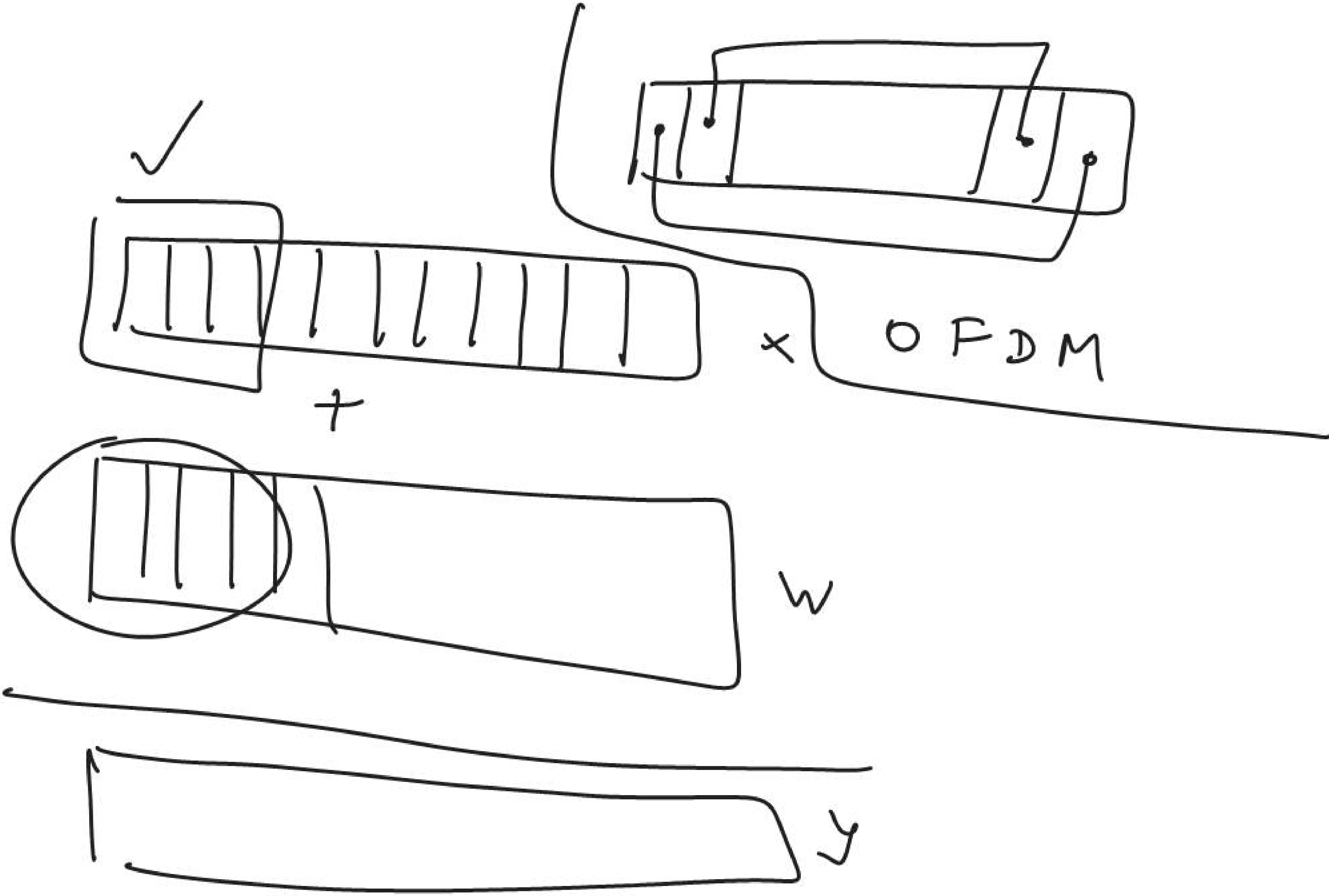
$$\min. \ \|s\|^2 \qquad [s^T \ r] \underbrace{\begin{bmatrix} I & 0 \\ 0 & 0 \end{bmatrix}}_{\succeq 0} \begin{bmatrix} s \\ r \end{bmatrix}$$

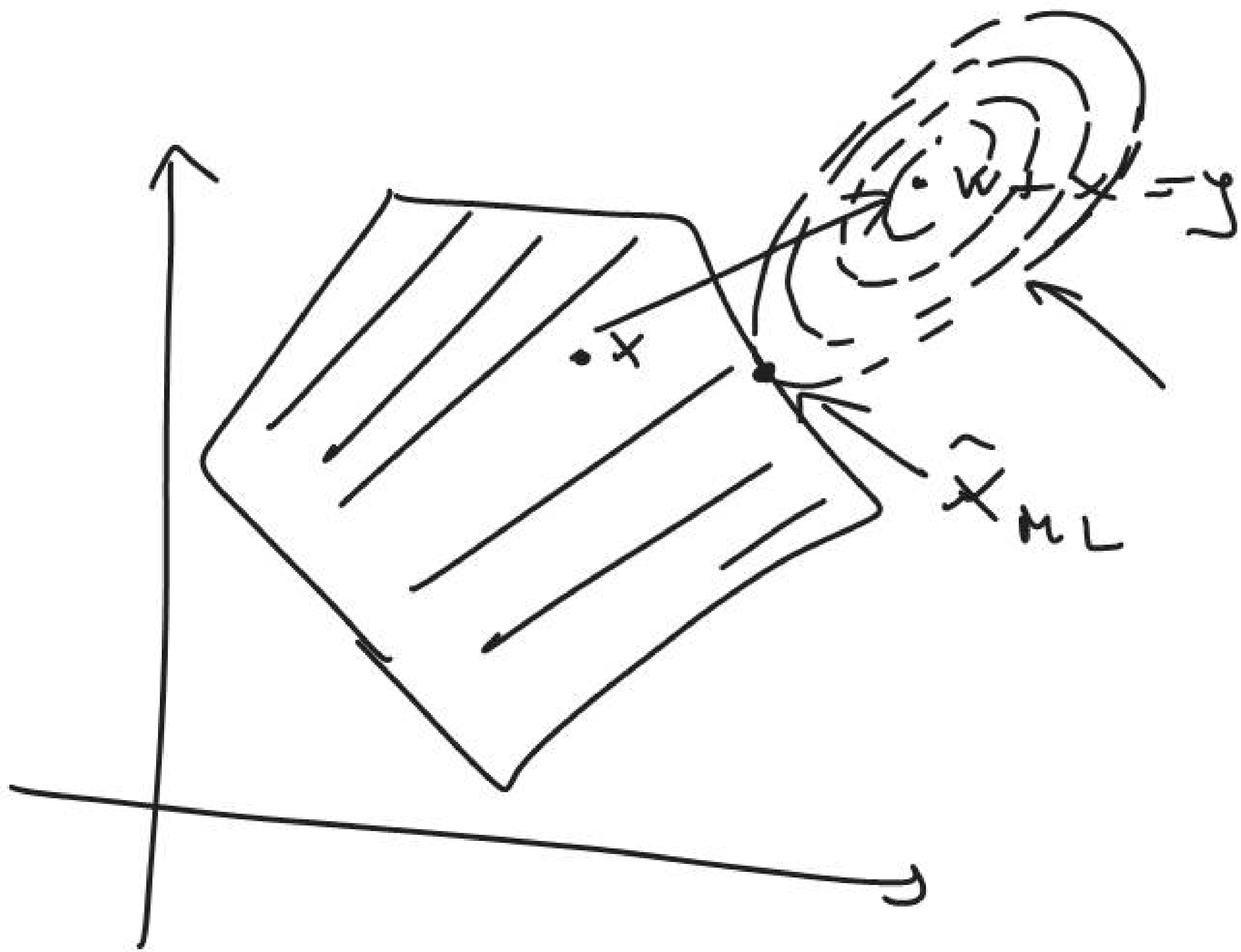
$$\text{s.t.} \quad s^T x_k \geq r+1, \ \forall_k$$

$$s^T y_\ell \leq r-1, \ \forall_\ell \qquad \begin{bmatrix} s \\ - \\ r \end{bmatrix}$$

CVX, QUAD.

$$\max. \ \frac{2}{\|s\|} \quad \text{s.t.} \ (*) \longrightarrow \min. \ \frac{\|s\|}{\cancel{2}} \quad \text{s.t.} \ (*) \longrightarrow \min. \ \|s\|^2 \quad \text{s.t.} \ (*)$$


x
OFDM
+
W
y



x
$W^{+}x = y$
$\hat{x}_{ML}$

$$x_{k+1} = A x_k = A^k x_0$$

$$x_0 \sim N(\mu, \Sigma)$$

$$\sim N(A^k \mu, A^k \Sigma A^{k^T})$$

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ \vdots \\ x_k \end{bmatrix} = \begin{bmatrix} 0 & & & \\ \Phi & \Phi & \cdots & 0 \\ & \ddots & & \\ 0 & \cdots & I & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_k \end{bmatrix}$$

$$x_{k+1} = A x_k + w_k$$

$$y_k = C x_k + v_k$$

$AR(1)$

$$x_{k+1} = A x_k + w_k \qquad x_0 \sim N(\mu_0, \Sigma_0)$$

$$w_k \overset{iid}{\sim} N(0, \Upsilon)$$

$$x = \overset{\mathcal{A}}{\begin{bmatrix} A \\ A^2 \\ \vdots \\ A^K \end{bmatrix}} x_0 + \overset{\mathcal{L}}{\begin{bmatrix} I & & & \\ A & I & & \\ A^2 & A & I & \\ \vdots & & & \ddots \\ & & & I \end{bmatrix}} \begin{bmatrix} w_0 \\ w_1 \\ \vdots \\ w_{K-1} \end{bmatrix} \sim N\left(\begin{bmatrix} A \\ A^2 \\ \vdots \end{bmatrix} \mu_0, \mathcal{A}\Sigma_0\mathcal{A}^T + \mathcal{L} \begin{bmatrix} \Upsilon & & \\ & \Upsilon & \\ & & \ddots \\ & & & \Upsilon \end{bmatrix} \mathcal{L}^T \right)$$

$$p(x_1, \ldots, x_K; A)$$

$$x_1 = A x_0 + w_0$$

$$x_2 = A x_1 + w_1$$
$$= A^2 x_0 + A w_0 + w_1$$

$$\underbrace{\begin{bmatrix} x_1 \\ \vdots \\ x_K \end{bmatrix}}_{x} = \begin{bmatrix} A x_0 \\ A^2 x_0 \\ \vdots \\ A^K x_0 \end{bmatrix} + \begin{bmatrix} w_0 \\ A w_0 + w_1 \\ A^2 w_0 + A w_1 + w_2 \\ \vdots \end{bmatrix}$$

$$\max_{A} \ \overbrace{\frac{1}{(2\pi)^{t/2} \left| A\,\Sigma_0 A^T + L \begin{bmatrix} r & & \\ & \ddots & \\ & & r \end{bmatrix} L^T \right|^{1/2}} \times e^{-\frac{1}{2}[x - A\mu_0]^T \Sigma^{-1} [x - A\mu_0]}}^{f(A)}$$

s.t. A

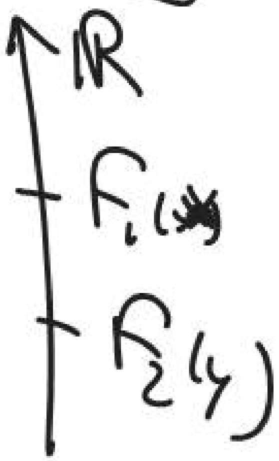
$p_1^* = \min.\ f_1(x)$

s.t. $x \in \Omega_1$

$p_2^* = \min.\ f_2(y)$

s.t. $y \in \Omega_2$

• $\boxed{\Longleftrightarrow}$



$\forall x \in \Omega_1\ \exists y \in \Omega_2 : f_2(y) \le f_1(x)$ $\quad p_2^* \le p_1^*$

$\forall y \in \Omega_2\ \exists x \in \Omega_1 : f_1(x) \le f_2(y)$ $\quad \Rightarrow \boxed{p_1^* = p_2^*}$ $\quad p_2^* \le p_1^*$

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