

# OPTIMIZING INPUTS FOR CONDITION & VARIANCE

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$$\underline{U}_0(k) \rightarrow \underline{R}(k) = R_{\text{sys}}(k) \begin{bmatrix} t_{11} & t_{12} & \dots & t_{1n_u} \\ t_{21} & t_{22} & & \\ \vdots & & \ddots & \\ t_{n_u 1} & & & t_{n_u n_u} \end{bmatrix} \begin{matrix} \text{CH 1} \\ \text{CH 2} \\ \vdots \\ \text{CH } n_u \end{matrix}$$

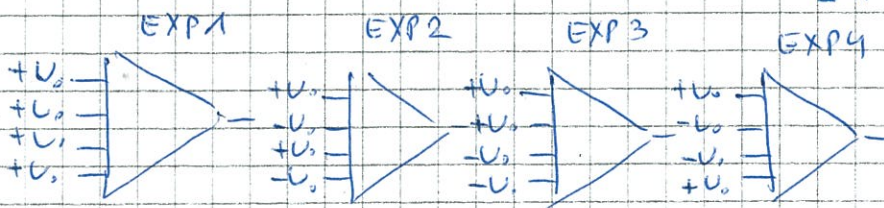
$$= \begin{bmatrix} t_{11} R(k) & \dots & t_{1n_u} R(k) \\ \vdots & & \vdots \\ t_{n_u 1} R(k) & \dots & t_{n_u n_u} R(k) \end{bmatrix}$$

$$\underline{T} \underline{T}^* = \underline{I}_{n_u}$$

$n_e = n_u$

EG.  $t_{ij} = \text{ONLY } \pm 1$

$$\underline{R}(k) = R_{\text{sys}}(k) \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -1 & 1 & -1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \end{bmatrix}$$



$$\underline{T} = \frac{1}{\sqrt{n_u}} \underline{H}_{2^n}$$

HADAMARD MATRIX

IF  $n_u$  DIVISIBLE BY 4

$$\underline{H}_{2^n} = \underline{H}_2 \otimes \underline{H}_{2^{n-1}}$$

$$\underline{H}_2 = \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$$

$$\underline{T} = \underline{F}_{n_u} \quad \text{DFT MATRIX} \quad \left[ \frac{1}{\sqrt{n_u}} e^{j \frac{2\pi (p-1)(q-1)}{n_u}} \right]$$

(ARBITRARY IF  $\underline{T} \underline{T}^* = \underline{I}_{n_u}$ )

D-OPTIMAL INPUTS

$$\text{MIN } |(X X^T)^{-1}|$$

$$\text{MAX DET } |\underline{U}_0|$$

VOLUME OF ERROR ELLIPSOID MINIMAL AROUND  $\hat{\underline{G}}$