$$\frac{\partial \mathcal{E}\{\}}{\partial g(m)} = \mathcal{E}\Big\{2\Big(\underbrace{\sum_k g(k)u(n-k) - y(k)}_{e(n)}\Big)u(n-m)\Big\} = \phi$$

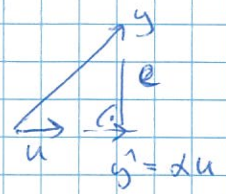
$$\mathcal{E}\{e(n)u(n-m)\} = R_{eu}(m) = \phi$$

FOR ALL m FOR WHICH $g(m)$ CAN BE FREELY CHOSEN

$e \perp u$

$\llcorner$ BASIS TO BUILT ESTIMATE

$\|\cdot\|_2^2$



ORTHOGONAL PROJECTION PRINCIPLE

ERROR $\perp$ TO ALL DATA USED TO COMPUTE THE ESTIMATE

$$R_{eu} = R_{\hat{y}u} - R_{yu}$$

$$R_{\hat{y}u} = R_{yu}$$

$$R_{\hat{y}u}(m) = g(m) * R_u(m) \longrightarrow \boxed{R_{yu}(m) = g(m) * R_u(m)}$$

DESIGN EQUATION

<u>FIR</u>

$$\begin{bmatrix} R_u(0) & \cdots & R_u(M-N) \\ \vdots & \ddots & \vdots \\ R_u(N-1) & \cdots & R_u(0) \end{bmatrix} \begin{bmatrix} g(0) \\ \vdots \\ g(N-1) \end{bmatrix} = \begin{bmatrix} R_{yu}(0) \\ \vdots \\ R_{yu}(N-1) \end{bmatrix}$$

IIR

$$\Phi_{yu}(z) = G(z)\,\Phi_u(z)$$

$$\left[\begin{aligned} \hat{G}(z) &= \frac{\Phi_{yu}(z)}{\Phi_u(z)} \\ \hat{G}(e^{j\omega}) &= \frac{\Phi_{yu}(\omega)}{\Phi_u(\omega)} \\ &\sim \frac{\frac{1}{N}\sum Y^{(k)}\bar{U}^{(k)}}{\frac{1}{N}\sum |U^{(k)}|^2} \end{aligned}\right]$$