

$$\hat{y}(t+1) = \hat{H}^{-1}(q) G(q) u(t) + [1 - \hat{H}^{-1}(q)] y(t) \quad (1) (2)$$

$$\sum_{k=1}^{\infty} \ell(k) u(t-k) \quad \sum_{k=1}^{\infty} (-\bar{h}(k)) y(t-k)$$

UNKNOWN INITIAL CONDITIONS $\rightarrow \phi$

$$\hat{y}(t+1) \approx \sum_{k=1}^t \ell(k) u(t-k) + \sum_{k=1}^t (-\bar{h}(k)) y(t-k)$$

PREDICTION ERROR:

$$y(t) - \hat{y}(t+1) = -\hat{H}^{-1}(q) G(q) u(t) + \hat{H}^{-1}(q) y(t) = e(t)$$

K-STEP- AHEAD

PREDICTION FILTER: OF $y(t)$
 $\hat{H}(q)$ UNKNOWN!

$$W_k(q) = 1 + \sum_{t=k}^{\infty} w_{t+k}^{-t}$$

$$W_k(q) y(t) = W_k(q) G(q) u(t)$$



$$y(t) = [1 - W_k(q)] y(t) + W_k(q) G(q) u(t)$$

$$\hat{y}(t|t-k) = [1 - W_k(q)] y(t) + W_k(q) G(q) u(t)$$

$$e(t) = y(t) - \hat{y}(t|t-k) = W_k(q) u(t)$$

$$\phi_e(e^{j\omega}) = |W(e^{j\omega})|^2 \phi_u(e^{j\omega})$$

DESIGN \leftarrow RAPID DECAY OF TRANSIENTS
 DECREASING $y(t)$ MEASURING ERRORS

$$W_k(q)$$

$$W_k(q) G(q)$$

$$1 - W_k(q) = W_y(q, \theta)$$

$$W_k(q) G(q) = W_u(q, \theta)$$

$$\left[\hat{y}(t|\theta) = W_y(q, \theta) y(t) + W_u(q, \theta) u(t) \right]$$

FUNDAMENTAL SYSTEM DESCRIPTION