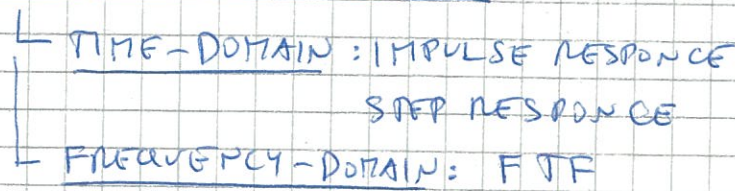


# NONPARAMETRIC SYSTEM MODELLING

(47)



## NONPARAMETRIC TIME-DOMAIN MODELING

### IMPULSE RESPONSE:

$$y(t) = G_0(q) u(t) + v(t)$$

$$\begin{aligned} y(t) &= \sum_{k=0}^{\infty} g_0(k) q^{-k} u(t) + v(t) \\ &= \sum g_0(k) u(t-k) + v(t) \\ &= A g_0(t) + v(t) \end{aligned}$$

$$u(t) = \begin{cases} A & t = \phi \\ \phi & t \neq \phi \end{cases}$$

DIRAC-DELTA  
KRONECKER-DELTA

IF NOISE LEVEL SMALL:  $\hat{g}_0(t) = \frac{1}{A} y(t)$

Error:  $e(t) = \frac{1}{A} v(t)$

### STEP RESPONSE:

$$u(t) = \begin{cases} A & t \geq \phi \\ \phi & t < \phi \end{cases}$$

$$y(t) = \sum_{k=0}^{\infty} g_0(k) u(t-k) + v(t) = A \sum_{k=0}^t g_0(k) + v(t)$$

$$\hat{g}_0(t) = \frac{y(t) - y(t-1)}{A} \quad e(t) = \frac{v(t) - v(t-1)}{A}$$

## CORRELATION ANALYSIS

$$\overline{\sum u(t) v(t-\tau)} = \phi$$

$$y(t) = \sum_{k=0}^{\infty} g_0(k) u(t-k) + v(t)$$

— a. STAT.,  $R_u(\tau)$

$$\overline{y(t) u(t-\tau)} = R_{yu}(\tau) = \sum_{k=0}^{\infty} g_0(k) R_u(k-\tau)$$

IF INPUT WHITE NOISE

$$R_u(\tau) = \alpha \delta_{k\tau}$$
$$= \alpha g_0(\tau)$$