CASE 2 – $u(t)$ PERIODIC, N – MULTIPLE OF PERIOD (5) (4)

$$|U_N(\omega)|^2 \nearrow \sim \text{CONST.}\, N$$

AT $\{\omega\} = \{2\pi k/N\}$ FIXED

ETFE – UNBIASED

– VARIANCE $\downarrow$ AS $\sim 1/N$

ETFE AS LS ESTIMATE

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

$$\Phi_y(\omega) = |G_0(e^{j\omega})|^2 \Phi_u(\omega) + \Phi_v(\omega)$$

$$\Phi_{yu}(\omega) = G_0(e^{j\omega})\, \Phi_u(\omega)$$

$\downarrow$ ESTIMATION

$$G_0(e^{j\omega}) = \frac{\Phi_{yu}(\omega)}{\Phi_u(\omega)}$$

$$y(t) = y_M(t) + v(t)$$

$G^{-1}(q)\, u(t)$ $\quad \left(= \underline{\Phi}^T(\omega)\, \underline{\theta} \right)$ (LINEAR REGRESSION)

CRITERION: $\quad \|Y_N - G \cdot U\|_2^2 \qquad \mathcal{E}\{|Y - GU|^2\}$ ETC.

$$\mathrm{Op}\ \begin{cases} \frac{1}{M}\sum_{k=1}^{M} \\ \mathcal{E}\{\cdot\} \end{cases} \left[|Y(\omega) - G_0(e^{j\omega})\, U(\omega)|^2 \right] \qquad \frac{\partial}{\partial G_0} = \phi$$

VARIATIONAL PRINCIPLE: $\quad \hat{G}_0 = G_0 + \varepsilon \cdot K$

K ARBITRARY

$$\frac{\partial}{\partial \varepsilon} \Box \Big|_{\varepsilon = \phi} = \phi$$