BUSSGANG - THEOREM (*)

$$R_{yu}(\tau) = C \cdot R_{uu}(\tau)$$

$u(t) \sim N(0, \sigma^2)$

$$\downarrow$$

$$S_{yu} = C \cdot S_{uu}$$

$$\downarrow$$

$$\hat{G}_{BLA} = C$$

LINEAR APROXIMATION OF STATIC NL IS STATIC (FOR GAUSSIAN!)

$$C = \mathcal{E}\{NL'(u(t))\}$$

BLA - BASED MODELING OF NONLINEAR SYSTEMS

(A) $G_{BLA} = \arg\min_{G} \mathcal{E}\{|Y(l) - G(q)U(l)|^2\}$

$$= \frac{S_{YU}}{S_{UU}} \leftarrow \frac{\hat{S}_{YU}}{\hat{S}_{UU}} = \frac{\sum_{k} Y^{(k)}(l)\,\overline{U^{(k)}(l)}}{\sum_{k} |U^{(k)}(l)|^2}$$ (*)

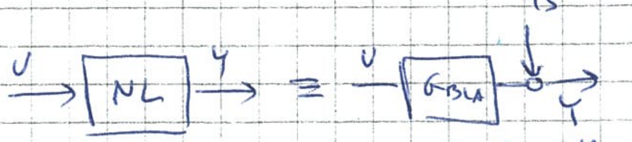
$\leftarrow$ FOR RMS DETERMINISTIC

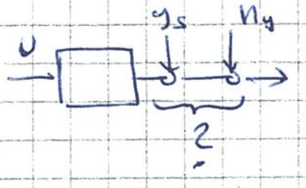
$$= \frac{\mathcal{E}\{Y(l)\overline{U(l)}\}}{\mathcal{E}\{|U(l)|^2\}}$$

(B) $Y_s(l) = Y(l) - G_{BLA} \cdot U(l)$ — STOCHASTIC NONLINEAR NOISE (DISTORTION)

$$\mathcal{E}\{Y_s(l)\overline{U(l)}\} = \emptyset \qquad O(M^{-1})$$

$$Y(l) = G_{BLA}U(l) + Y_s(l)$$





$$Y(l) = G_{BLA}U(l) + Y_s(l)$$
$$= \left(G^{1}(l) + G_B(l)\right)U(l) + Y_s(l)$$

$\llcorner$ NL BIAS (SYSTEMATIC) DISTORTION ON LINEAR SYSTEM (IF PRESENT)

(*) NFIR $y(t) = f(u(t-k))\Big|_{k=0}^{M}$

BLA(NFIR) = FIR OF ORDER M IF $u(t)$ SEPARABLE OF ORDER $M+1$

$$\mathcal{E}\{u(t-\sigma) \mid u(t), u(t-1), \ldots u(t-M)\} = \sum_{i=0}^{M} a_{\sigma i} \cdot u(t-i)$$

(GAUSSIAN ∞ ORDER)