ASSUME: $\lim_{N\to\infty} \frac{1}{N}\sum_{k=1}^{N} x(k) = \mathcal{E}\{x(k)\}$

$\mathcal{E}\{n_u \cdot n_i\} = \phi$ NOISES INDEPENDENT

$\lim_{N\to\infty} \frac{1}{N}\sum_{k} n_i(k)\, n_u(k) = \phi$

$\lim_{N\to\infty} \frac{1}{N}\sum_{k=1}^{N} \left(x(k) - \mu\right)^2 = \sigma_x^2$ VARIANCE

ZERO MEAN NOISES

$$\boxed{\begin{aligned} u(n) &= U_0 + n_u(n) \\ i(n) &= I_0 + n_i(n) \end{aligned}}$$

BIAS ANALYSIS

(3) $\lim \hat{R}_{EV} = \lim \frac{\sum \cdots}{\sum \cdots} = \frac{\lim \sum \cdots}{\lim \sum \cdots}$

$$= \frac{\lim \sum (U_0 + n_u(n))}{\lim \sum (I_0 + n_i(n))} = \frac{U_0 + \lim \frac{1}{N}\sum n_u}{I_0 + \lim \frac{1}{N}\sum n_i} = \boxed{\frac{U_0}{I_0} = R_0}$$

BIAS $\equiv \phi$

(1) $\lim \hat{R}_{SA} = \lim \frac{1}{N}\sum \frac{u(k)}{i(k)} = \lim \frac{1}{N}\sum (U_0 + n_u(k)) \times \frac{1}{I_0}\sum_{\ell=0}^{\infty} (-1)^{\ell}\left(\frac{n_i(k)}{I_0}\right)^{\ell}$

$\frac{1}{1+x} = 1 - x + x^2 \mp \cdots, \quad |x| < 1$

IF $\left|\frac{n_i(k)}{I_0}\right| < 1$ (*)

ODD TERMS → YIELD ϕ

EVEN —"— → ONLY (2)

$$\simeq \frac{1}{N}\sum_{k=1}^{N} (U_0 + n_u(k))\frac{1}{I_0}\left(1 + \left(\frac{n_i(k)}{I_0}\right)^2\right)$$

$$= \frac{U_0}{I_0}\frac{1}{N}\sum \left(1 + \frac{n_u}{U_0}\right)\left(1 + \left(\frac{n_i(k)}{I_0}\right)^2\right)$$

$$= \frac{U_0}{I_0}\left(1 + \frac{1}{N}\sum n_u + \frac{1}{N}\sum \frac{n_i^2}{I_0^2}\right) \to \boxed{R_0\left(1 + \frac{\sigma_i^2}{I_0^2}\right)}$$

– IF |*| < 1 ONLY

└ AND IF INPUT NOISE = GAUSSIAN ?
WHAT IS THE PROBLEM ?

IS GAUSSIAN IMPORTANT ? (CENTRAL LIMIT THEOREM)