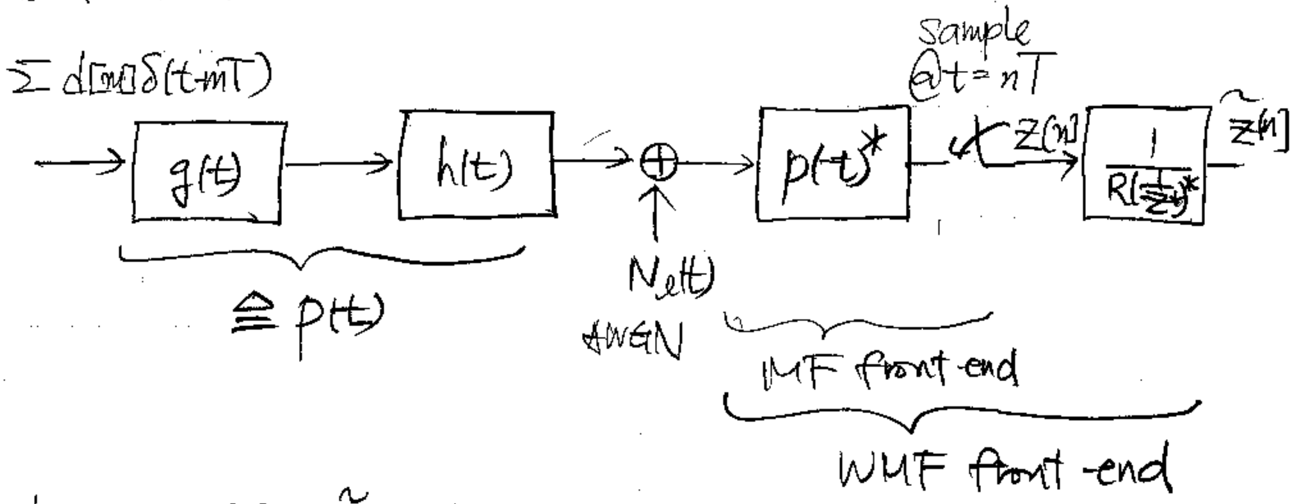
Review of handout #15

o WMF front-end



Where $q[n] \triangleq \tilde{p}(nT)$

$\Updownarrow$

$Q(z) = \underbrace{R(z)}_{\text{minimum phase}} R\left(\frac{1}{z^*}\right)^*$

rational transfer function approximation

$\Updownarrow$

$r[n] \qquad \sum_{n=0}^{N} |r[n]|^2 \geq \sum_{n=0}^{N} |\tilde{r}[n]|^2 \quad \forall N \geq 0.$

causal.

$$\tilde{z}[n] = \sum_{m=-\infty}^{\infty} d[m]\, r[n-m] + \underbrace{\tilde{N}_e[n]}_{\text{white}}$$

o Why is $\{\tilde{N}_e[n]\}_n$ white?

(i) $N_e(t) * p(-t)^*$ has the PSD $S_{N_eN_e}(f)|P(f)|^2 = 2N_0|P(f)|^2$. Thus, the auto-correlation function is $2N_0\tilde{p}(t)$. (ii) the auto-correlation function of $N_e(t) * p(-t)^*|_{t=nT}$ is $2N_0\tilde{p}(nT)$. Thus, the PSD is $\frac{2N_0}{T}\sum_m |P(\frac{f-m}{T})|^2$. (iii) The PSD of the noise component $\tilde{N}_\ell[m]$ in $\tilde{Z}[m]$ is

$$\frac{2N_0}{T}\sum_m \left|P\left(\frac{f-m}{T}\right)\right|^2 \times \frac{1}{|R(e^{j2\pi f})|^2}$$

$$= \frac{2N_0}{T} Q(e^{j2\pi f}) \times \frac{1}{Q(e^{j2\pi f})} = \frac{2N_0}{T}$$

Therefore, the noise component is white.