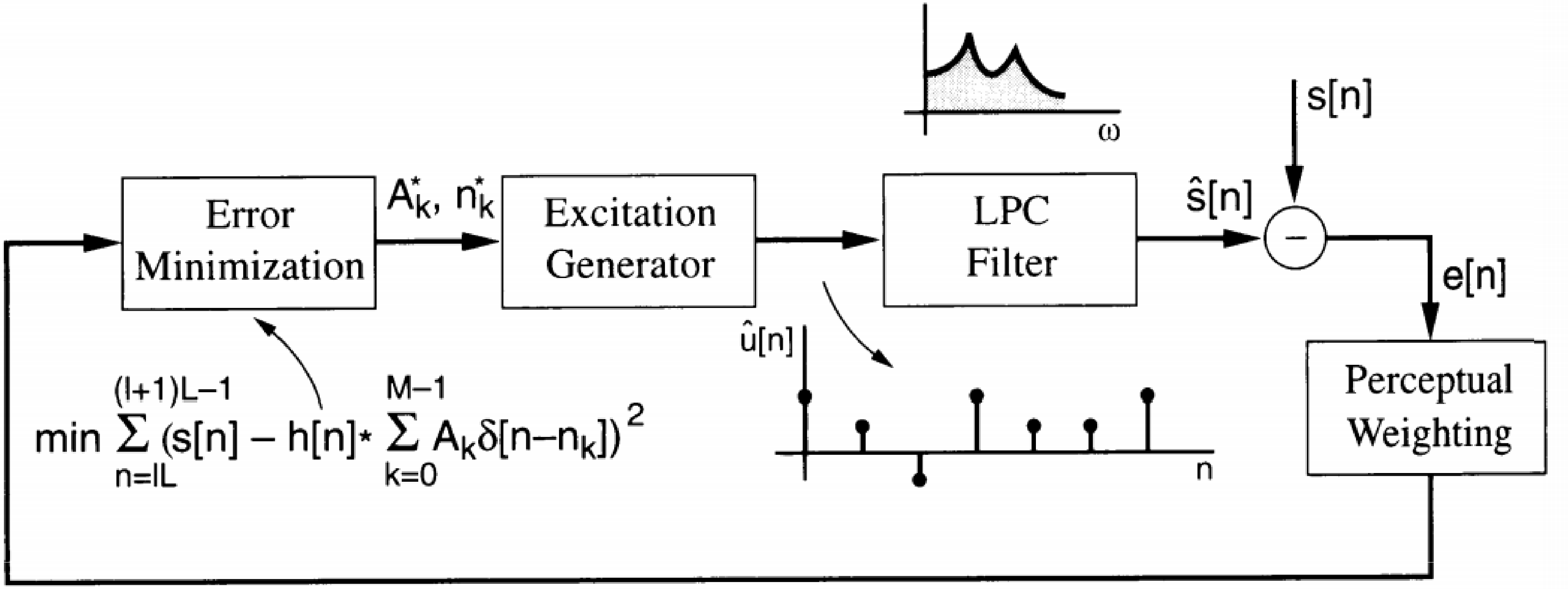
$$A_p(z) = A_{p-1}(z) + k_p z^{-p} A_{p-1}(1/z)$$

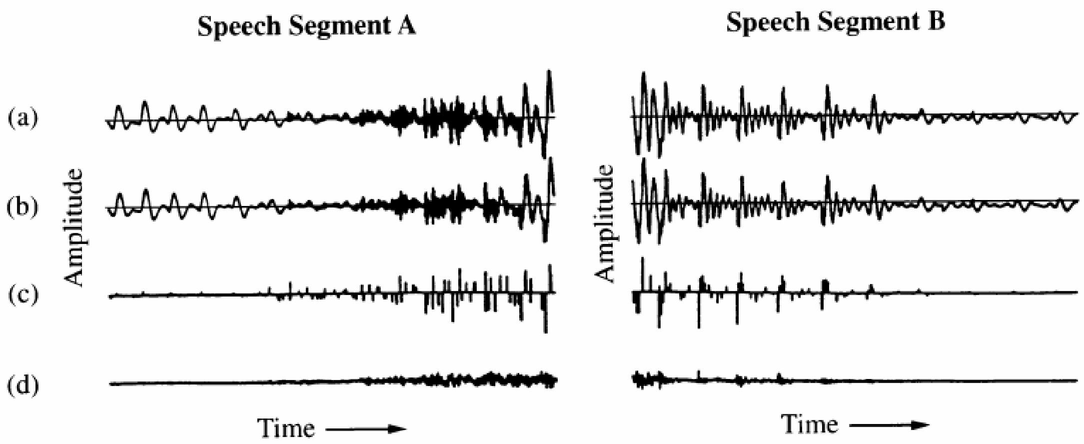
Let $k_{m+1} = 1$ $\quad P(z) = A_m(z) + z^{-(m+1)} A_m(1/z)$ $\quad \begin{cases} 1 & a_1 & a_2 & \cdots & a_{m-1} & a_m \\ & a_m & a_{m-1} & \cdots & a_2 & a_1 & 1 \end{cases}$ Symm

$k_{m+1} = -1$ $\quad Q(z) = A_m(z) - z^{-(m+1)} A_m(1/z)$ $\quad \begin{cases} 1 & a_1 & a_2 & \cdots & a_{m-1} & a_m \\ & -a_m & -a_{m-1} & & -a_2 & -a_1 & -1 \end{cases}$ anti Symm

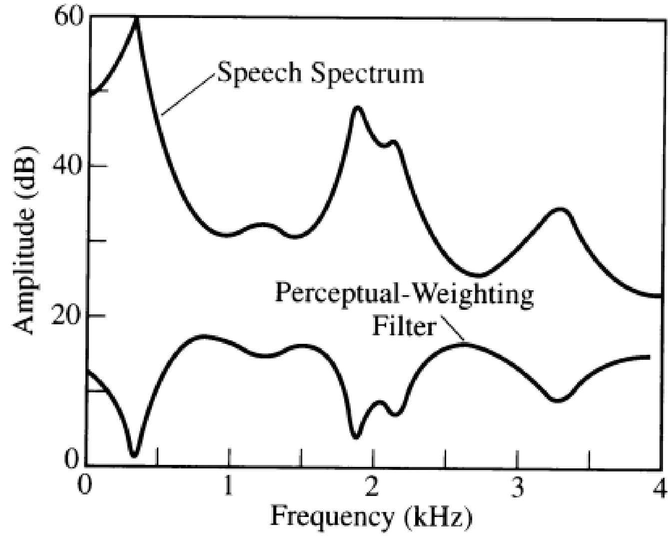
$$A_m(z) = \frac{1}{2}\left[P(z) + Q(z)\right]$$

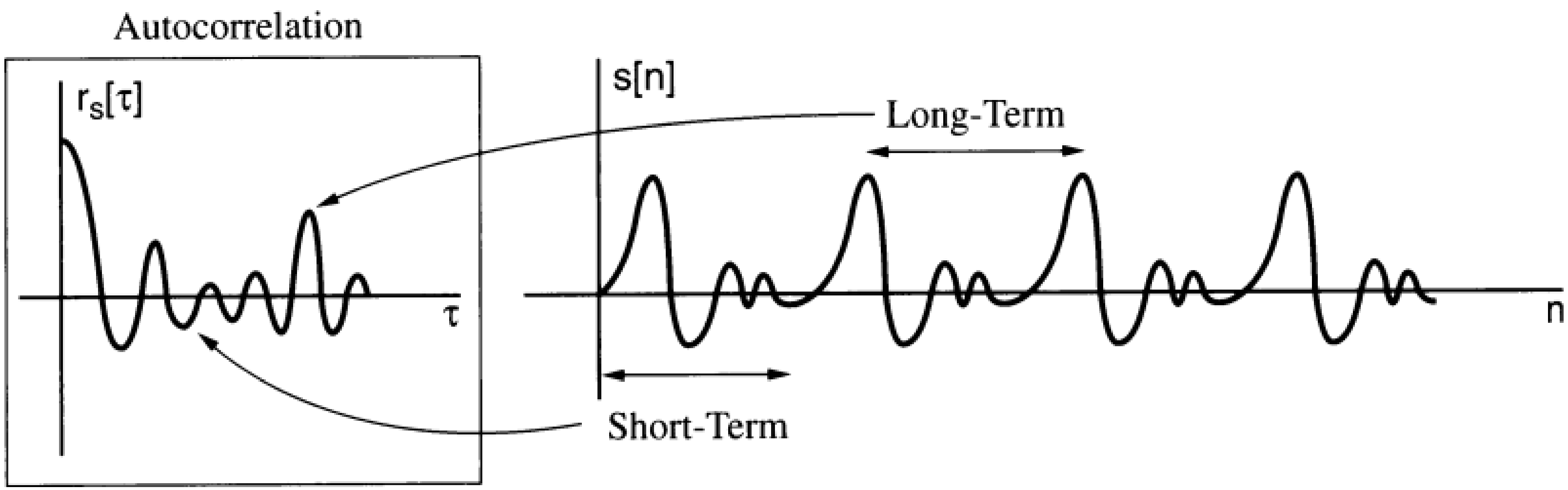
* All zeros of P(z) & Q(z) are on the unit circle (LSP)
* Zeros of P(z) & Q(z) are interlaced with each other
* Minimum phase property of Am(z) is preserved after quantization of the zeros of P(z) & Q(z)



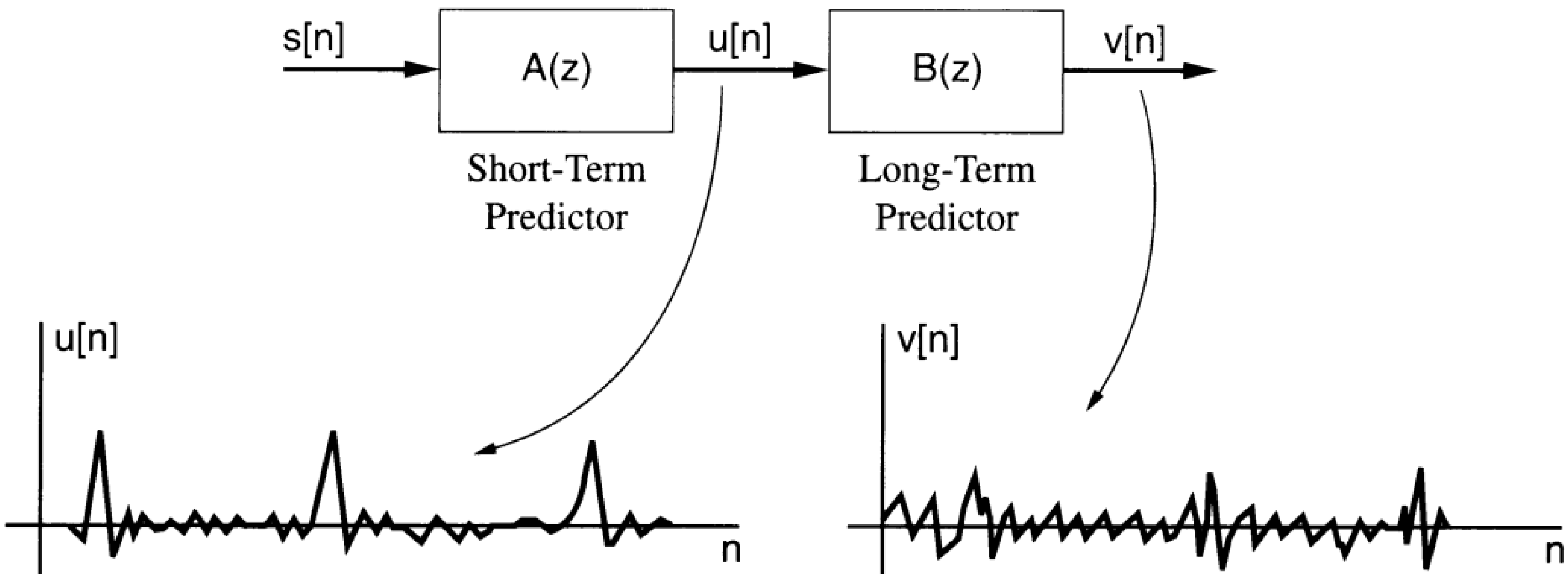


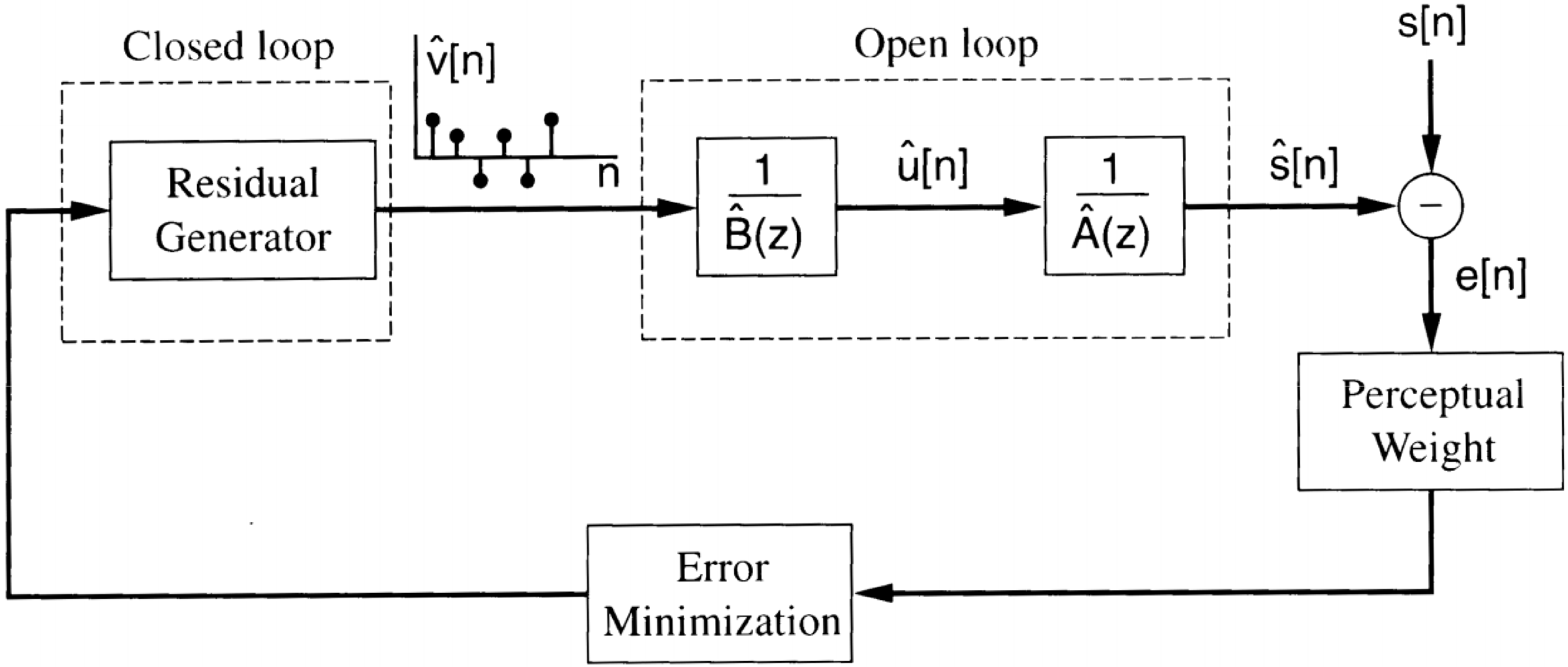
$$Q(z) = \frac{1-P(z)}{1-P(z/\alpha)} = \frac{1-\Sigma_{k=1}^{p} a_k z^{-k}}{1-\Sigma_{k=1}^{p} a_k (z/\alpha)^{-k}}$$




Autocorrelation
rs[τ]
τ
s[n]
Long-Term
n
Short-Term

$$B(z) = 1 - bz^{-P}$$


s[n]
A(z)
u[n]
B(z)
v[n]
Short-Term
Predictor
Long-Term
Predictor
u[n]
n
v[n]
n



Closed loop
Residual Generator
v̂[n]
n
Open loop
1/B̂(z)
û[n]
1/Â(z)
ŝ[n]
s[n]
e[n]
Perceptual Weight
Error Minimization