Measuring "voicing" with the S-T ACF

$$s[n] = H[n] + z[n] \quad \ldots (1)$$

speech

perfectly periodic signal of per $= T_0$

$$r_s[k] = \sum_m s[m]\,s[m+k]$$

From (1)

$$r_s[k] = r_H[k] + r_z[k] \quad \ldots (2)$$

We have : $r_H(k = T_0) = r_H[0]$

(2) $\Rightarrow$

$$r_s[0] = r_H[0] + r_z[0]$$

$$r_s[T_0] = r_H[0] + \underbrace{r_z[T_0]}_{=0}$$

$$\Rightarrow \frac{r_s[T_0]}{r_s[0]} = \frac{r_H[0]}{r_H[0] + r_z[0]}$$

rel power of harmonic component

Apply a threshold : $\dfrac{r_s[T_0]}{r_s[0]} \gtrless Thr$

Rel^n between ACF & Power spectrum

If $$X(n,\omega) = \sum_{m=-\infty}^{\infty} x[m]\,w[n-m]\,e^{-j\omega m}$$

& $$S(n,\omega) = |X(n,\omega)|^2$$

then $$r(n,k) \xrightarrow{FT} S(n,\omega)$$

i.e. $$S(n,\omega) = \sum_{k=-\infty}^{\infty} r(n,k)\,e^{-j\omega k}$$

$$r(n,k) = \frac{1}{2\pi}\int_{-\pi}^{\pi} S(n,\omega)\,e^{jk\omega}\,d\omega$$