Deterministički signali (53)

periodični

$c_k = \frac{1}{T_0}\int_{-T_0/2}^{T_0/2} x(t)e^{-jk\omega_0 t}dt = |c_k|e^{-j\theta_k} = \frac{A\tau}{T}\frac{\sin(\frac{k\omega\tau}{2})}{\frac{k\omega\tau}{2}}$

c $=\frac{A}{2}$ sin/cos signal

$Ovojnica$=0 za $\frac{k}{\tau}$

$x(t) = \sum_{-\infty}^{\infty} c_k e^{jk\omega_0 t}$

$P = \lim_{k\to\infty}\left[\frac{1}{kT_0}k\int_0^{T_0}|x(t)|^2 dt\right] = \frac{1}{T_0}\int_0^{T_0}|x(t)|^2 dt = \sum_{k=-\infty}^{\infty}|c_k|^2$

$P = |c_0|^2 + 2\sum_{k=1}^{\infty}|c_k|^2 = A^2\frac{\tau}{T}$

$P = \frac{A^2}{2}$ sin/cos signal

neperiodični

$X(f) = \int_{-\infty}^{\infty} x(t)e^{-j2\pi ft}dt$ ili $X(\omega) = \int_{-\infty}^{\infty} x(t)e^{-j\omega t}dt,\ \omega = 2\pi f$

$X(f) = |X(f)|e^{j\theta(f)}$

$\boldsymbol{X(f) = A\tau * \frac{sin(\frac{2\pi f\tau}{2})}{\frac{2\pi f\tau}{2}}}$

$x(t) = \int_{-\infty}^{\infty} X(f)e^{j2\pi ft}df$ ili $x(t) = \frac{1}{2\pi}\int_{-\infty}^{\infty} X(\omega)e^{j\omega t}d\omega$

$E = \int_{-\infty}^{\infty}|x(t)|^2 dt = \int_{-\infty}^{\infty}|X(f)|^2 df = \frac{1}{2\pi}\int_{-\infty}^{\infty}|X(\omega)|^2 d\omega$

$E = A^2\tau$ pravokutni impuls

$E = \lim_{T\to\infty}\int_{-T}^{T}|x(t)|^2 dt = \int_{-\infty}^{\infty}|x(t)|^2 dt,$

$P = \lim_{T\to\infty}\frac{1}{2T}\int_{-T}^{T}|x(t)|^2 dt.$

$\boldsymbol{cos\omega t = \frac{1}{2}(e^{j\omega t} + e^{-j\omega t})}$	$\boldsymbol{E < \infty \to P = 0}$	***Xdb=10log10*** X	$\int_{-\infty}^{\infty}\delta(t-t_0)x(t)dt = x(t_0)$
$\boldsymbol{sin\omega t = \frac{1}{2}(e^{j\omega t} - e^{-j\omega t})}$	$\boldsymbol{P > 0 \to E \to \infty}$	$\boldsymbol{e^{-at}o -* \frac{1}{s+a}}$	
$\boldsymbol{sin(x) = cos(x - \frac{\pi}{2})}$	$\boldsymbol{E \to \infty\ i\ P \to \infty}$		

Slučani signali (63) npr.Gaussov bijeli šum(64)

srednja vrijednost slučajnog procesa $\mu_X(t) = E[X(t)] = \int_{-\infty}^{\infty} x f_X(x,t)dx$ $\quad \mu_Y = \mu_X H(0)$

n(t)=signal šuma

N0=spektralna gustoća gaussovog bijelog šuma

Sn(f)=spektralna gustoća snage, $S_X(f) = \int_{-\infty}^{\infty} R_X(\tau)e^{-j2\pi f\tau}d\tau$ [W/Hz] $\quad S_Y(f) = S_X(f)|H(f)|^2$

$S_W(f) = \sigma^2\int_{-\infty}^{\infty}\delta(t)e^{-j2\pi ft}dt = \sigma^2$ i $S_N(f) = \frac{N_0}{2}, \forall f \in$ **za bijeli šum**

Rn(t)=autokorelacijska funkcija $R_X(\tau) = \int_{-\infty}^{\infty} S_X(f)e^{j2\pi f\tau}df$ $\quad R_W(\tau) = \sigma^2\delta(\tau)$ **za bijeli šum**

P(t)=srednja snaga šuma $P = E[X^2(t)] = R_X(0) = \int_{-\infty}^{\infty} S_X(f)df$

LTI (67)

***h(t)*, H(t)=impulsni odziv sustava** $y(t) = \int_{-\infty}^{\infty} x(\tau)h(t-\tau)d\tau = \int_{-\infty}^{\infty} h(\tau)x(t-\tau)d\tau$

$y(t) = x(t)*h(t) = h(t)*x(t)$

$H(f) = \int_{-\infty}^{\infty} h(t)e^{-j2\pi ft}dt$

$h(t) = \int_{-\infty}^{\infty} H(f)e^{j2\pi ft}df$

prigušenje kanala $\boldsymbol{A(f) = \frac{1}{|H(f)|}}$

NPK: $\boldsymbol{|X(f)| \approx 0\ za\ |f| > fg, B = fg}$

PPK: $|\boldsymbol{X(f)}| > 0\ samo\ ako\ je\ \boldsymbol{fg > |f| > fd, B = fg - fd}$

A/D pretvorba (79)

1. **UZORKOVANJE (79)**

$\boldsymbol{R = fu * r = brzina\ prijenosa\ bita}$

$\boldsymbol{fu = 2B}$ ***Nyquist***

2. **KVANTIZACIJA PCM (95)**

Kvantizacijske razine $\mathbf{L = 2^r}$

Kvantizacisjki šum $\mathbf{(S/N) = \frac{3}{2} * 2^{2r}}$ $\quad (S/N) = \frac{S}{\sigma_Q^2} = \left(\frac{3S}{m_{\max}^2}\right)2^{2r}$

amplitude ulaznog signala (-mmax, mmax)

korak kvantizacije $\mathbf{\Delta = \frac{2mmax}{L}}$

kvantizacijski šum je ograničen: $\mathbf{-\frac{\Delta}{2} \leq q \leq \frac{\Delta}{2}}$

funkcija vjerojatnosti razine u(t): p(u)

srednja kvadratna greška $\mathbf{Oq^2 = \frac{1}{3}mmax^2 * 2^{-2r}}$

KAPACITET (101)

$\boldsymbol{N = BN_0}$ $\quad S_N(f) = \frac{N_0}{2}, \forall f \in$ **za bijeli šum** ***AWGN kanal***

R= $C = B\log\left(1 + \frac{S}{N_0 B}\right)$ [bit/s] ***=2BD (D=dinamika)***

Pojačanje: A=(S2/S1)