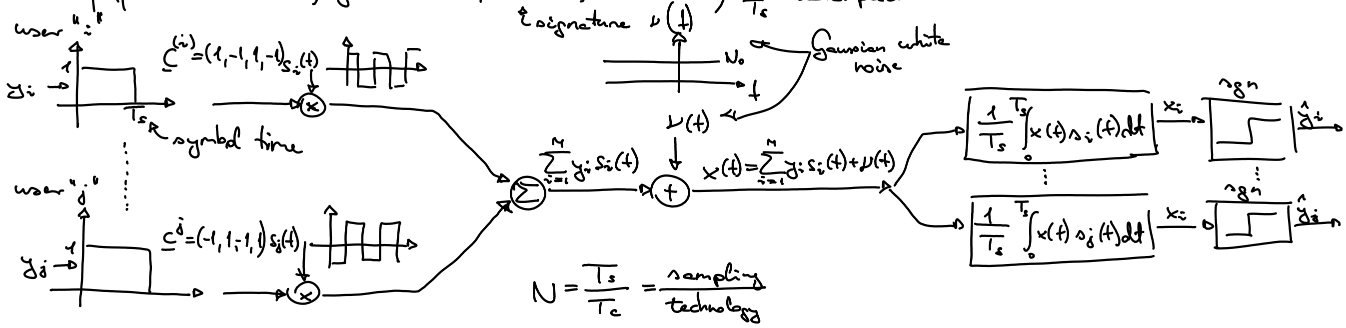
2016. november 30., szerda 16:22

User population: $1\ldots M$; $y_i \in \{-1;1\}$, $s_i(t)$; $i=1\ldots M$, $\frac{1}{T_s}$: dataspeed



$N=\frac{T_s}{T_c}$ = sampling technology

$$x_\ell := \frac{1}{T_s}\int_0^{T_s} x(t)s_\ell(t)\,dt = \frac{1}{T_s}\int_0^{T_s}\left(\sum_{i=1}^M y_i s_i(t)+\nu(t)\right)s_\ell(t)\,dt = \sum_{i=1}^M y_i \frac{1}{T_s}\int_0^{T_s} s_\ell(t)s_i(t)\,dt + \frac{1}{T_s}\int_0 \nu(t)s_\ell(t)\,dt$$

$$R_{\ell i} := \frac{1}{T_s}\int_0^{T_s} s_\ell(t)s_i(t)\,dt = \frac{1}{N}\sum_{m=1}^N c_m^{(\ell)}\cdot c_m^{(i)} = \frac{1}{N}\underline{c}^{(\ell)T}\underline{c}^{(i)}$$

$\nu_\ell := \frac{1}{T_s}\int_0^{T_s} s_\ell(t)\nu(t)\,dt$; $x_\ell = \sum_{i=1}^M R_{\ell i}y_i + \nu_\ell$: $\ell = 1\ldots M$

$$\underline{y}\in\{-1;1\}^M \longrightarrow \boxed{\underline{R}} \longrightarrow \overset{\underline{\nu}}{\oplus} \xrightarrow{\underline{x}=\underline{R}\,\underline{y}+\underline{\nu}}$$

$$x_\ell = R_{\ell\ell}y_\ell + \underbrace{\sum_{i,i\neq\ell} R_{\ell i}y_i}_{\text{MUI: multi user interference}} + \nu_\ell$$

⇒ our enemy that we want to destroy ⇒ let set $R_{\ell i}=0$ $\forall i$ ⇒ choose orthogonal codes

$\hat{y}_\ell = \mathrm{sgn}\{R_{\ell\ell}y_\ell + \sum_{i,i\neq\ell} R_{\ell i}y_i + \nu_\ell\}$

$R_{\ell i} = 0 = \frac{1}{N}\sum_{m=1}^N c_m^{(\ell)}c_m^{(i)} = \frac{1}{N}\underline{c}^{(\ell)T}\underline{c}^{(i)}$

$i=1\ldots M$, $i\neq\ell$

$M<N=\frac{T_s}{T_c}$ → $4 \div 6$ (high speed service)
→ 1000 (voice)

Walsh-Hadamard construction:

$$\left.\begin{array}{l}
\underline{H}_{2\times2}=\begin{bmatrix}1 & 1\\ 1 & -1\end{bmatrix}\\[2mm]
\underline{H}_{4\times4}=\begin{bmatrix}\underline{H}_{2\times2} & \underline{H}_{2\times2}\\ \underline{H}_{2\times2} & -\underline{H}_{2\times2}\end{bmatrix}\\[2mm]
\ldots\\[2mm]
\underline{H}_{(N+1)\times(N+1)}=\begin{bmatrix}\underline{H}_{N\times N} & \underline{H}_{N\times N}\\ \underline{H}_{N\times N} & -\underline{H}_{N\times N}\end{bmatrix}
\end{array}\right\}\; M<2^L \rightarrow \text{Challange of 3G}$$