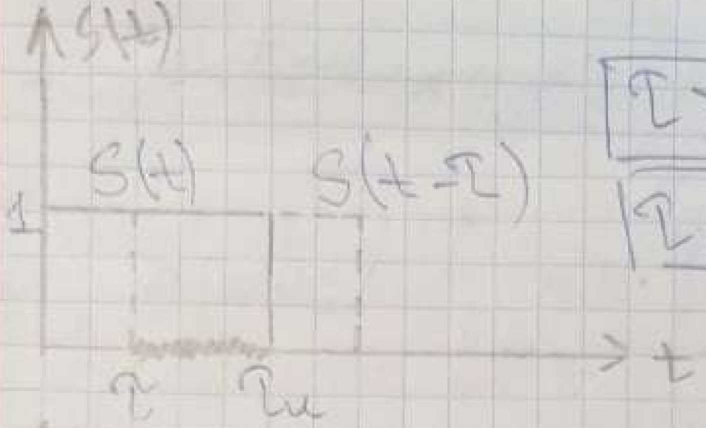
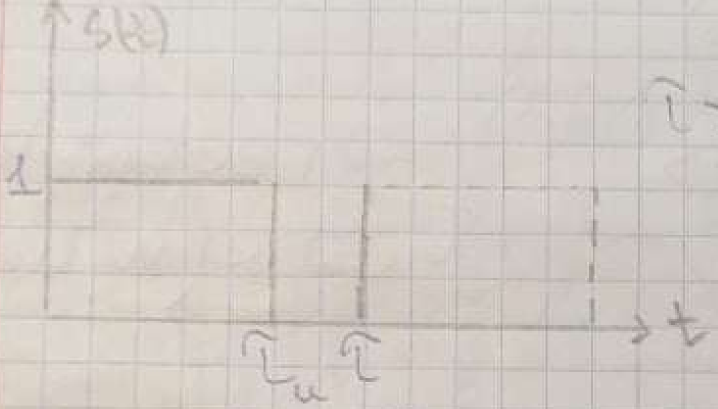


$\boxed{\tau > 0}$

$\boxed{\tau \le \tau_u}$



$\tau \ge \tau_u$

$R_s^+(\tau) = 0$

$R_s(0)$ - max

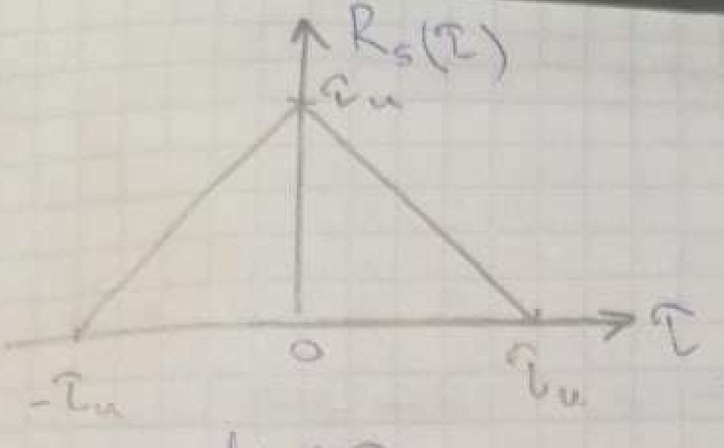
$$R_s^+(\tau) = \int_{-\infty}^{+\infty} s(t)\cdot s(t-\tau)\,dt =$$

$$= \int_{\tau}^{\tau_u} A\cdot A\,dt = \int_{\tau_u}^{\tau_u} 1\cdot 1\,dt = \boxed{\tau_u - \tau_u}$$

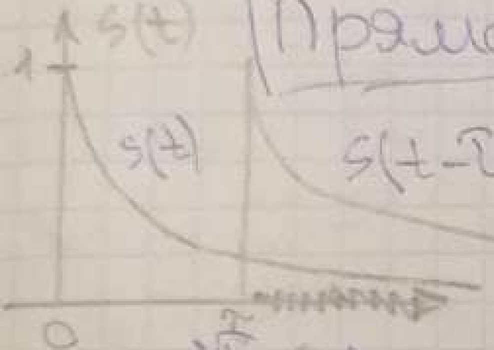
АКФ - симметричная

$$R_s(\tau) = R_s^+(|\tau|)$$

$$R_s(\tau) = \begin{cases} \tau_u\left(1 - \frac{|\tau|}{\tau_u}\right), & 0 \le |\tau| \le \tau_u \\ 0, & |\tau| > \tau_u \end{cases}$$



Найти АКФ эксп. импульса

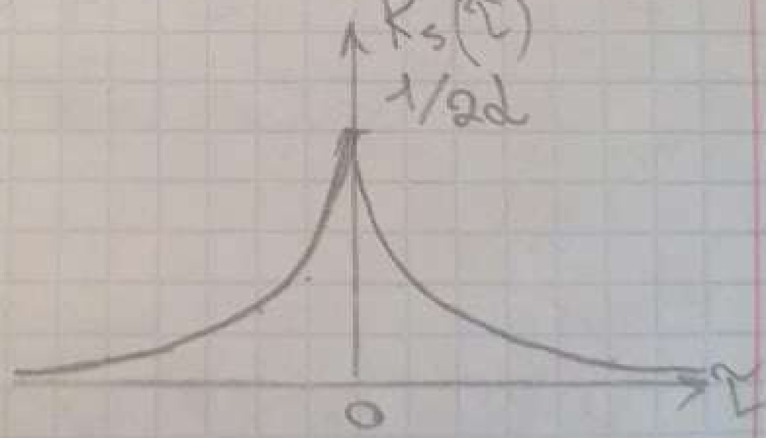


$\boxed{\text{Прямой метод}}$

$$R_s(\tau) = \int_{\tau}^{+\infty} e^{-\alpha t} \cdot e^{-\alpha(t-\tau)}\,dt = \int_{\tau}^{+\infty} e^{-\alpha t} \cdot e^{-\alpha t} \cdot e^{\alpha\tau}\,dt =$$

$$= e^{\alpha\tau} \cdot \frac{1}{-2\alpha} \cdot e^{-2\alpha t}\Big|_{\tau}^{+\infty} = \frac{e^{\alpha\tau}}{-2\alpha}\left(0 - e^{-2\alpha\tau}\right) =$$

$$= \frac{e^{-\alpha|\tau|}}{2\alpha}$$



$\boxed{\text{Спектр мет.}}$

$$W_s(w) = |S(w)|^2 = S(w) \cdot S^*(w) =$$

$$= \frac{1}{\alpha + jw} \cdot \frac{1}{\alpha - jw} = \frac{A}{\alpha + jw} + \frac{B}{\alpha - jw} =$$

$$= \frac{A\alpha - jA\omega + B\alpha + j\omega B}{(\alpha + j\omega)(\alpha - j\omega)}$$

$$\begin{cases} A\alpha + B\alpha = 1 \\ A\omega + B\omega = 0 \end{cases} \Rightarrow \quad \alpha(A+B) = 1, \quad A = B = 1/2\alpha$$

$$W_s(\omega) = \frac{1}{2\alpha}\left(\frac{1}{\alpha + j\omega} + \left(\frac{1}{\alpha + j\omega}\right)^*\right)$$

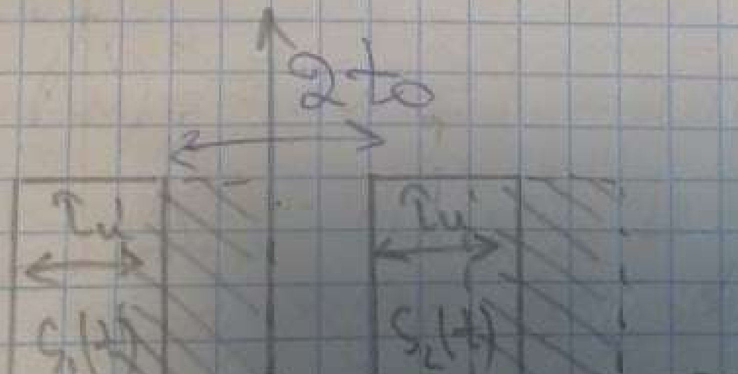
$$R_s(\tau) = F^{-1}\{W_s(\omega)\} =$$

$$= \frac{1}{2\alpha}\left(F^{-1}\left\{\frac{1}{\alpha + j\omega}\right\} + F^{-1}\left\{\left(\frac{1}{\alpha + j\omega}\right)^*\right\}\right)$$

$$= \frac{1}{2\alpha}\left(\sigma(\tau)e^{-\alpha t} + \sigma(-\tau)e^{\alpha t}\right) =$$

$$= \frac{1}{2\alpha} e^{-\alpha|\tau|}$$

Найти АКФ сигнала



$s(t) = s_1(t) + s_2(t)$

$s_1(t) = s_0(t + t_0)$ $\quad \tau = \tau_2 - \tau_1 = \tau - t_0 - t_0 =$

$s_2(t) = s_0(t - t_0)$ $\quad = \tau - 2t_0$

$\boxed{R_s^+(\tau)} = R_{s_1}^+(\tau) + R_{s_2}^+(\tau) + R_{s_2 s_1}^+(\tau) + \underset{=0}{R_{s_1 s_2}^+(\tau)}$

т.к. они не пересек.

$R_{s_1}^+(\tau) = R_{s_2}^+(\tau) = R_{s_0} =$

$= \tau_u \left(1 - \frac{\tau}{\tau_u}\right) \mathrm{rect}\left(\frac{\tau}{2\tau_u}\right)$

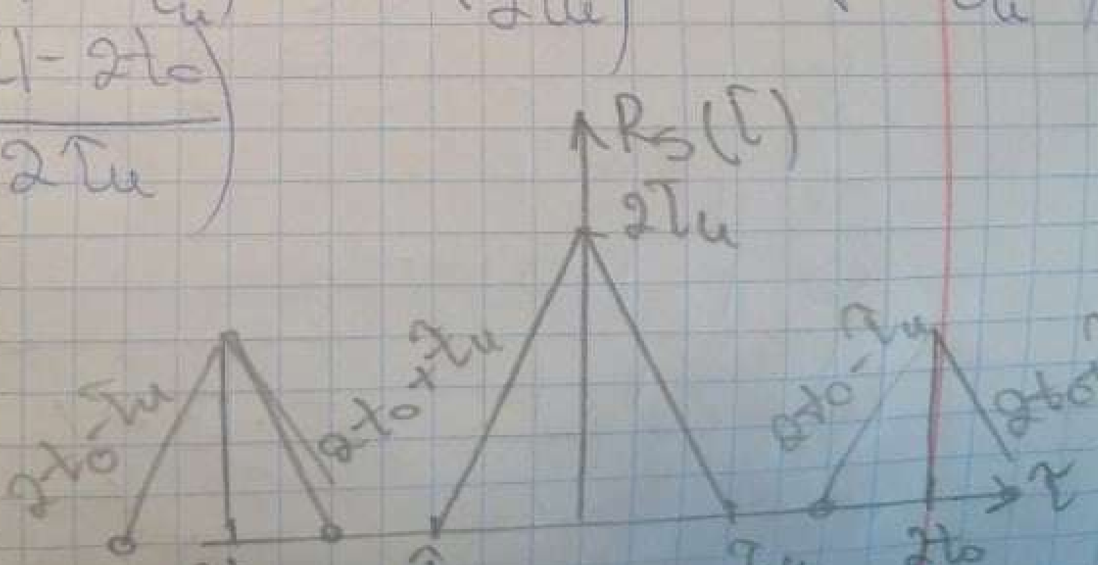
$R_{s_2 s_1}(\tau) = \int_{-\infty}^{+\infty} s_2(t) s_1(t - \tau) dt =$

$= \int_{-\infty}^{+\infty} s_0(t - t_0) s_1(t + t_0 - \tau) dt =$

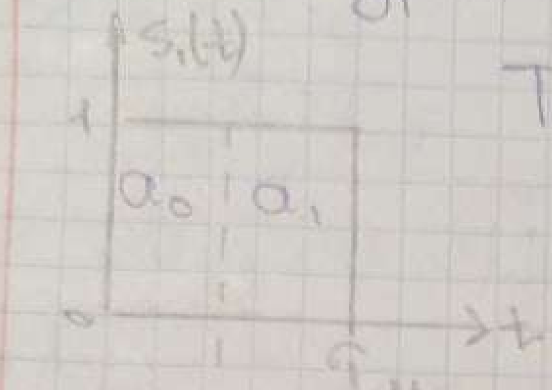
$= R_{s_0}(\tau - 2t_0)$

$= 2\tau_u \cdot \left(1 - \frac{|\tau|}{\tau_u}\right) \mathrm{rect}\left(\frac{|\tau|}{2\tau_u}\right) + \tau_u \left(1 - \frac{|\tau| - 2t_0}{\tau_u}\right) \cdot$

$\cdot \mathrm{rect}\left(\frac{|\tau| - 2t_0}{2\tau_u}\right)$

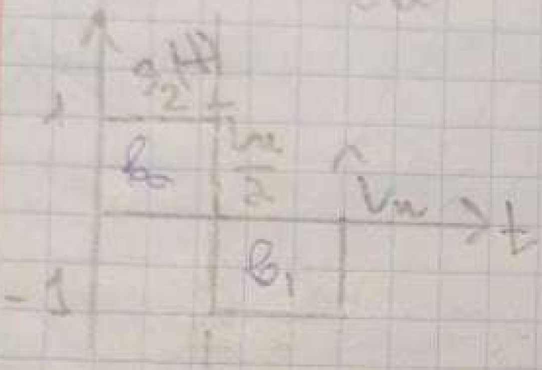


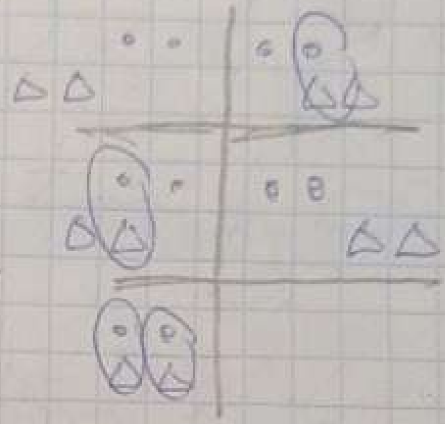
ВКФ прямоуг. имп. и меандра одинак. длит.



$T = \tau_u/2$

$N = 2$





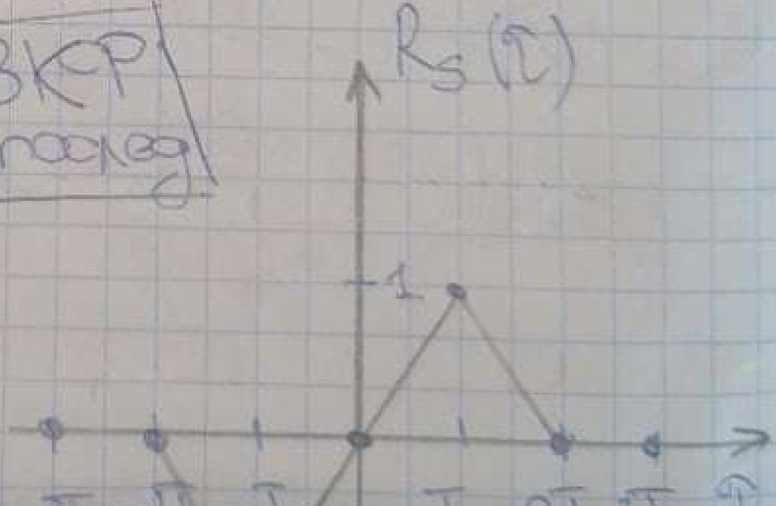
k	a_0	a_1	r_k
$-(N-1)$	b_1		$a_0 \cdot b_1$
$-(N-1)+1$	b_0	b_1	$a_0 \cdot b_0 + a_1 \cdot b_1$
$-(N-1)+2$		b_0	$a_1 \cdot b_0$

$a_0 = 1 \quad a_1 = 1$

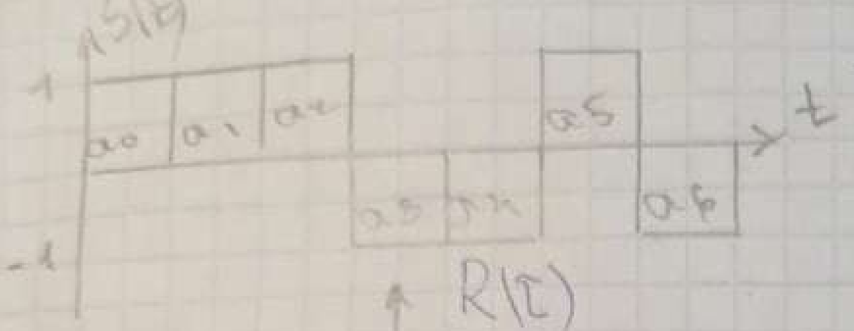
$b_0 = 1 \quad b_1 = -1$

$\boxed{\text{ВКФ послед}}$

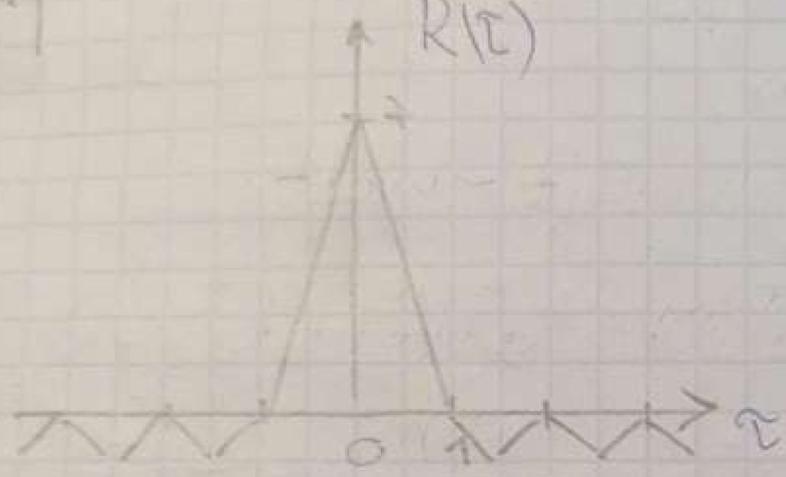
K	1	1	r_K
-1	-1		-1
0	1	-1	0
1		1	1



АКФ 7ми-элементного кода Баркера



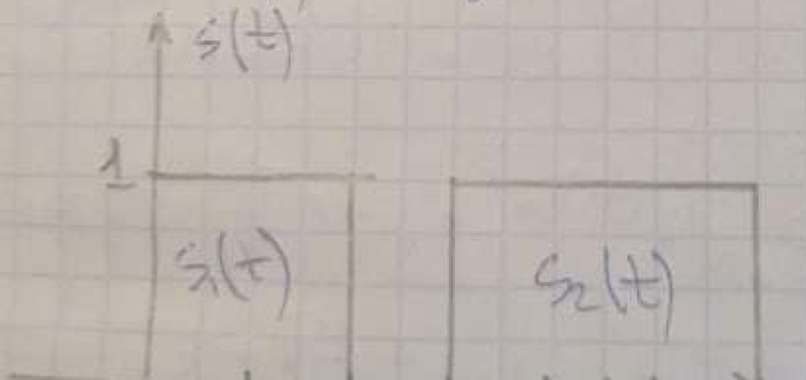
K	+	+	+	−	−	+	−	
	+	+	+	−	−	+	−	7
		+	+	+	−	−	+	0
			+	+	+	−	−	−1
				+	+	+	−	0
					+	+	+	−1
						+	+	0
							+	−1



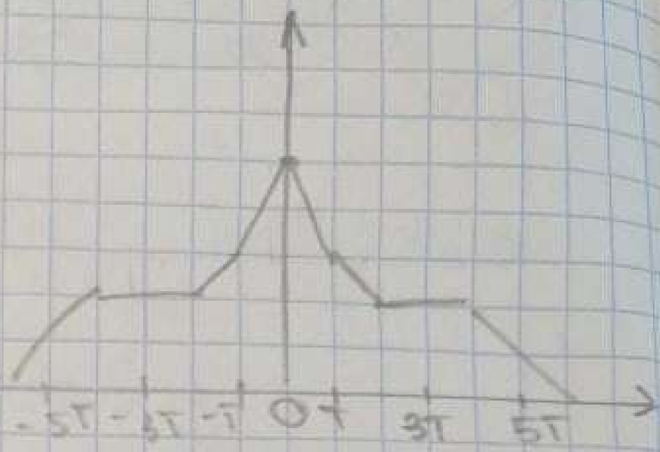
АКФ сигнала из двух прямоуг. импульсов разной длит.

$\tau_{u_1} = t_1$; $\tau_{u_2} = 3/2\, t_1$

$s(t) = s_1(t) + s_2(t)$



k	+ + 0 + + +	r_k
0	+ + 0 + + +	5
1	+ + 0 + +	4
2	+ + 0 +	3
3	+ + 0	2
4	+ +	2
5	+	1



$$R_s(\tau)=\int_{-\infty}^{+\infty} s(t)\cdot s(t-\tau)\,dt$$

$$R_s^+(\tau)=R_{s_1}^+(\tau)+R_{s_2}^+(\tau)+R_{s_1s_2}^+ + R_{s_2s_1}^+(\tau)$$

$$R_{s_1}^+(\tau)=2T\left(1-\frac{|\tau|}{2T}\right)rect\left(\frac{t}{4T}\right)$$

$$R_{s_2}^+(\tau)=3T\left(1-\frac{|\tau|}{2T}\right)rect\left(\frac{t}{6T}\right)$$

$R_{s_1s_2}^+(\tau)=0$ s_1 и s_2 - не пересек.

$$R_{s_2s_1}^+(\tau)=\int_{-\infty}^{+\infty} s_2(t)\cdot s_1(t-\tau)\,dt=$$

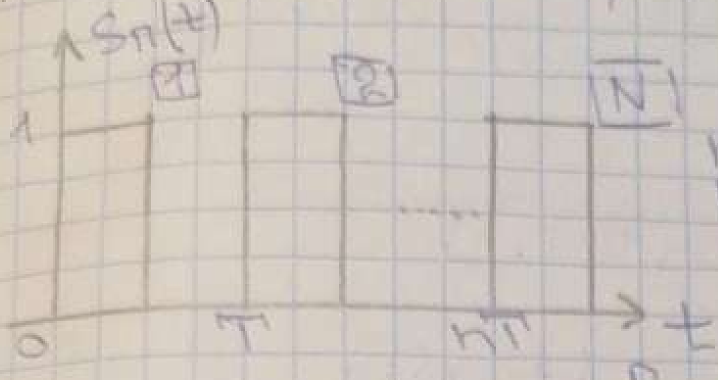
$$=\int_{-\infty}^{+\infty} s_{02}(t-t_2)\cdot s_{01}(t-\tau-t_2)\,dt=$$

$=R_s$

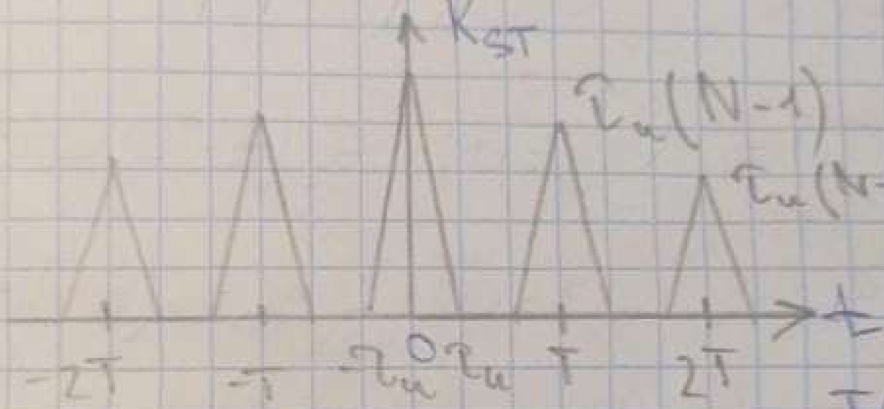
$t_2=4{,}5T;\ t_1=T$

$\tau=\tau_2-\tau_1=\tau+4{,}5T-T=\tau+3{,}5T$

АКФ пачки импульсов



пачка из N импульсов



для период. $R_{s\,пер}(\tau) = \frac{1}{T}\int_{-T/2}^{T/2} s(t)\cdot s(t-\tau)d$

$R_{s\,пер}(\tau) = R_{ST}(\tau)\cdot T_1$

пачка

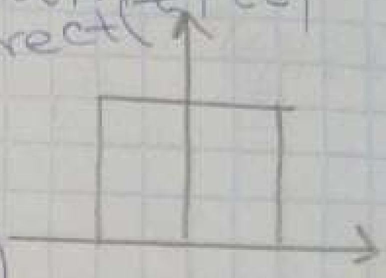
$$s(t) = \sum_{n=0}^{N-1} s_0(t-nT)$$

$s_0(t)$ – первый импульс в пачке

$$R(\tau) = \sum_{n=0}^{N-1}(N-n)R_0(\tau-nT) \qquad \boxed{T \geq \tau_и}$$

ВКФ кодированных сигналов

$T_{01} = T_{02} = 0$ $\qquad s_0(t) = rect(t/\tau_c)$



$$s_1(t) = \sum_{-\infty}^{+\infty} a_n s_0(t-nT)$$

$$s_2(t) = \sum_{-\infty}^{+\infty} b_n s_0(t-nT)$$

$$R_s(\tau) = \int_{-\infty}^{+\infty} s_1(t)\cdot s_2(t-\tau)\,dt =$$

$$= \int_{-\infty}^{+\infty} \sum_{-\infty}^{+\infty} a_n s_0(t-nT) \sum_{-\infty}^{+\infty} b_m s_0(t-\tau-mT)\,dt$$

$$= \sum_{n,m} a_n b_m \int_{-\infty}^{+\infty} s_0(t-nT)\, s_0(t-(\tau+mT))\,dt$$

$$= \sum_{n,m} a_n b_m R_0(\tau+mT-nT) =$$

$$= \sum_{n,m} a_n b_m R_0(\tau-(n-m)T) =$$

$$= \begin{bmatrix} k=n-m \\ m=n-k \end{bmatrix} = \sum_{n=-\infty}^{+\infty} \sum_{k=-\infty}^{+\infty} a_n b_{n-k} R_0(\tau-kT)$$

$$= \sum_{k=-\infty}^{+\infty} \left(\sum_{n=-\infty}^{+\infty} a_n b_{n-k} \right) R_0(\tau-kT) =$$

$$= \sum_{k=-\infty}^{+\infty} r_k \cdot R_0(\tau-kT)$$

$$\boxed{r_k = \sum_{k=\infty}^{+\infty} a_n b_{n-k}}$$