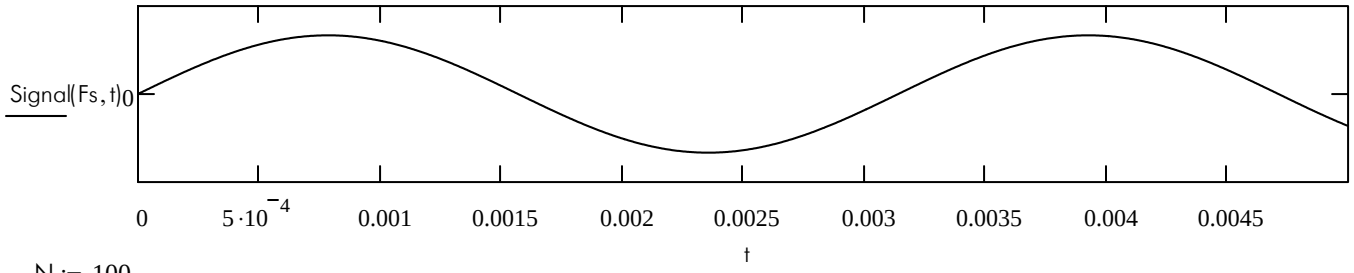
Лабораторная Работа N1

Дискретизация Сигналов

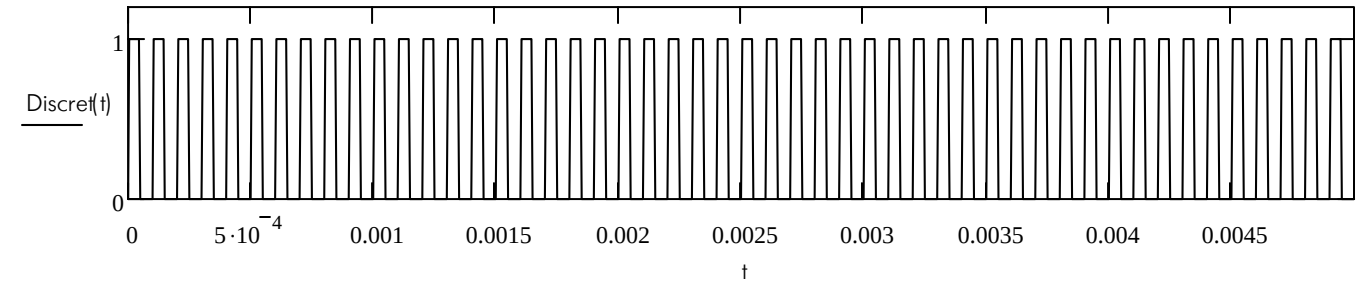
1. Исследование Зависимости Спектра Дискретизированного Гармонического от длительности импульсов дискретизирующей последовательности

$Signal(Fs, t) := \sin(Fs \cdot t)$ $Fs := 2kHz$ $Tc := \pi \cdot \frac{2}{Fs}$ $Tc = 3.142 \times 10^{-3}\,s$

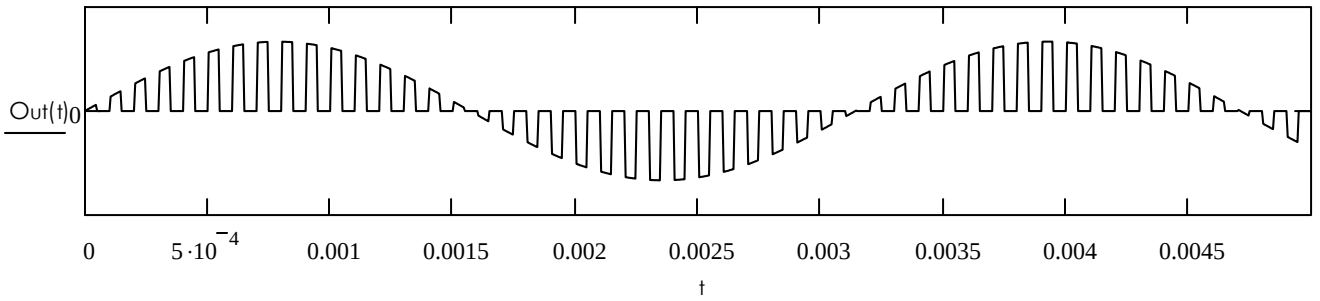


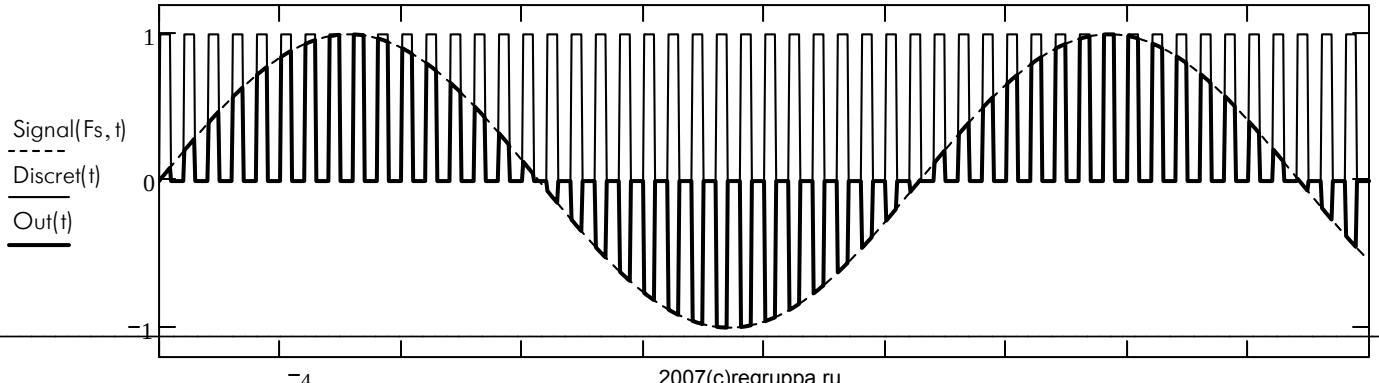
$N := 100$

$\tau := 50 \cdot 10^{-6}\,sec$ $T := 100 \cdot 10^{-6}\,sec$ $rect(x) := \begin{cases} 1 & \text{if } \frac{-1}{2} < x < \frac{1}{2} \\ 0 & \text{otherwise} \end{cases}$ $Discret(t) := \sum_{n=0}^{N-1} rect\left(\frac{-n \cdot T + t - \frac{\tau}{2}}{\tau}\right)$



$Out(t) := Signal(Fs, t) \cdot Discret(t)$





$q := \frac{T}{\tau}$ $q = 100$ $Fs := 2kHz$ $F := 0kHz, 1kHz .. 500kHz$

$\tau := 1 \cdot 10^{-6} sec$ $T := 100 \cdot 10^{-6} sec$

$$Xsignal(F, Fs) := \begin{cases} 1 & \text{if } \frac{F}{Fs} = 1 \\ 0 & \text{otherwise} \end{cases}$$

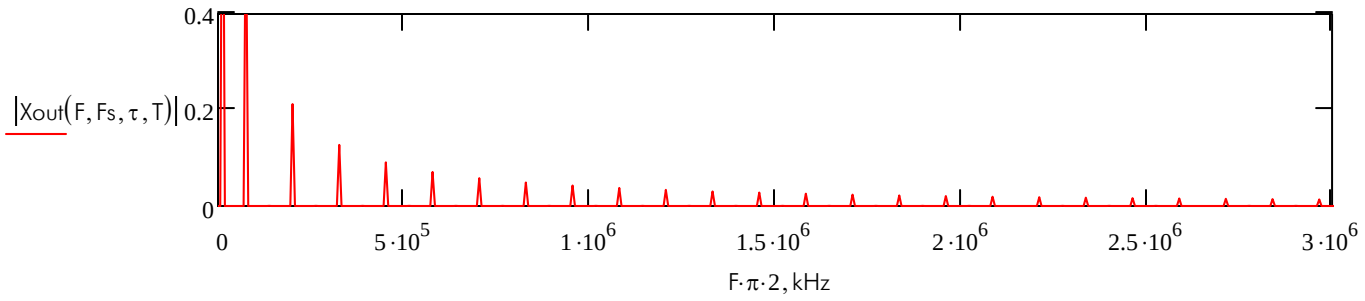
$$2 \cdot \frac{\pi}{\tau} = 6.283 \times 10^6 \frac{1}{s}$$

$$\frac{2}{T} = 2 \times 10^4 \frac{1}{s}$$

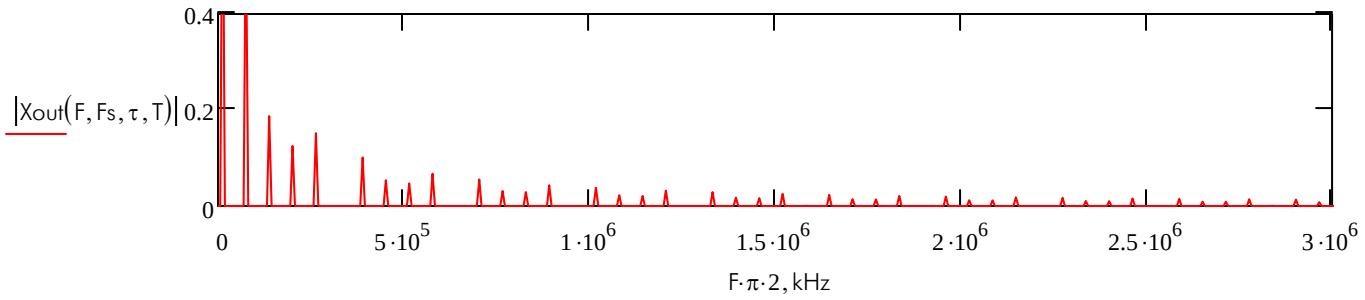
$$Xout(F, Fs, \tau, T) := \left[\sum_{n=1}^{300} \left[\left(\frac{2}{n \cdot \pi} \right) \cdot \sin\left(\pi \cdot n \cdot \frac{\tau}{T} \right) \cdot Xsignal\left(F - \frac{n}{T}, Fs \right) \right] \right] + \left(2 \cdot \frac{\tau}{T} \right) \cdot Xsignal(F, Fs)$$

Зависимость Спектра От Длительности Дискретизирующих Импульсов

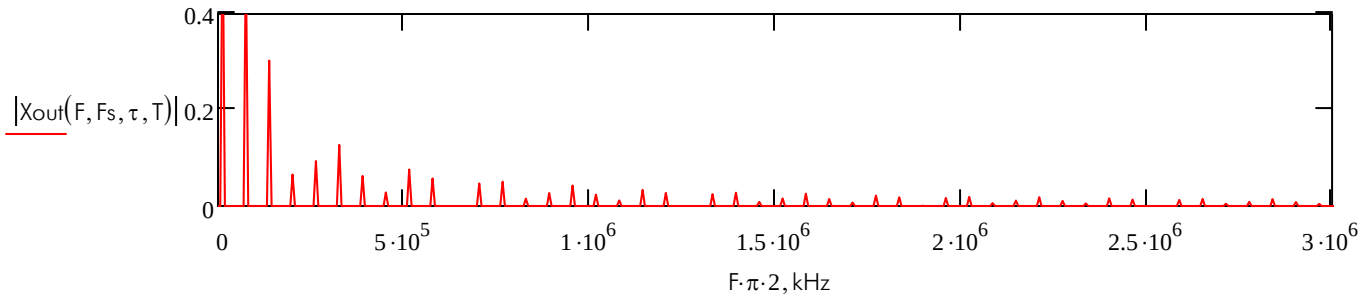
1 $\tau := 50 \cdot 10^{-6} sec$ $2 \cdot \frac{\pi}{\tau} = 1.257 \times 10^5 \frac{1}{s}$



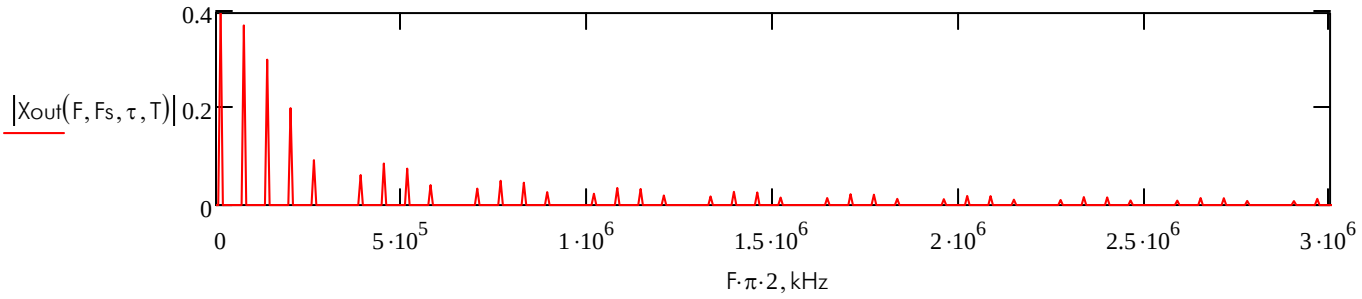
2 $\tau := 40 \cdot 10^{-6} sec$ $2 \cdot \frac{\pi}{\tau} = 1.571 \times 10^5 \frac{1}{s}$



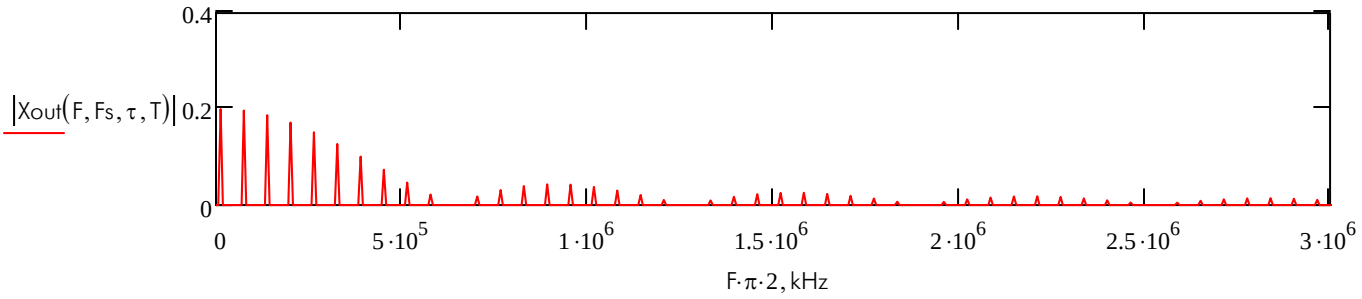
3 $\tau := 30 \cdot 10^{-6} sec$ $2 \cdot \frac{\pi}{\tau} = 2.094 \times 10^5 \frac{1}{s}$



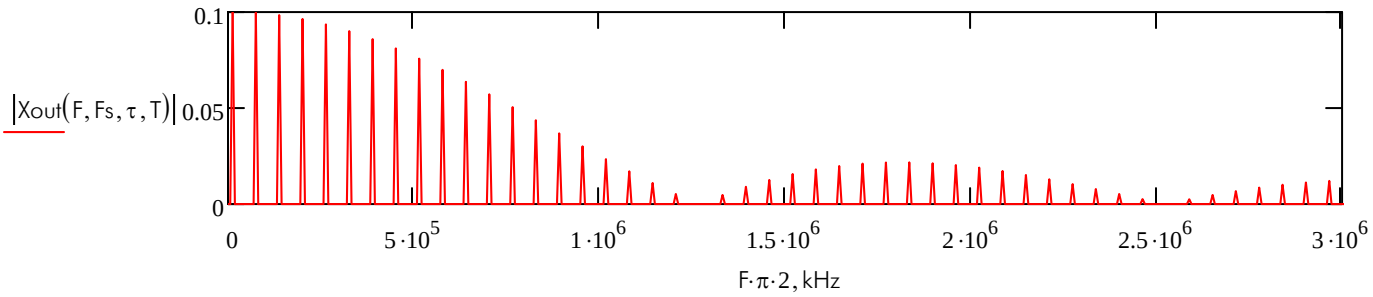
4 $\tau := 20\cdot10^{-6}\,\text{sec}$ $2\cdot\frac{\pi}{\tau} = 3.142\times10^{5}\,\frac{1}{s}$



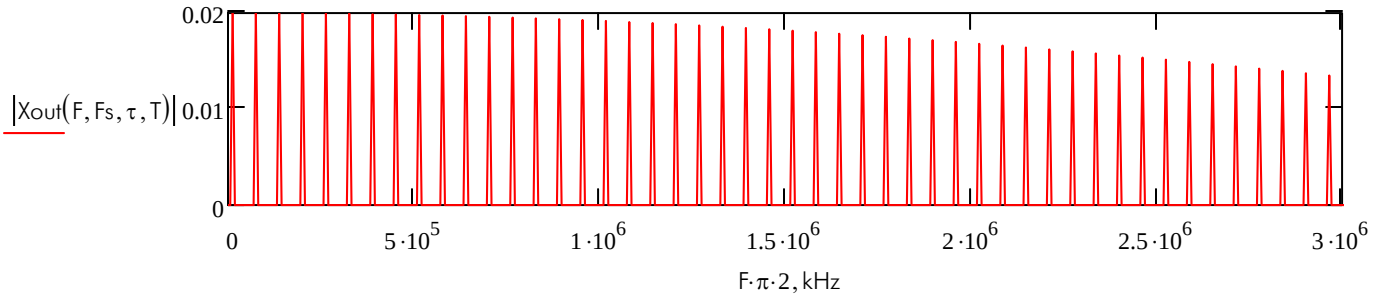
5 $\tau := 10\cdot10^{-6}\,\text{sec}$ $2\cdot\frac{\pi}{\tau} = 6.283\times10^{5}\,\frac{1}{s}$



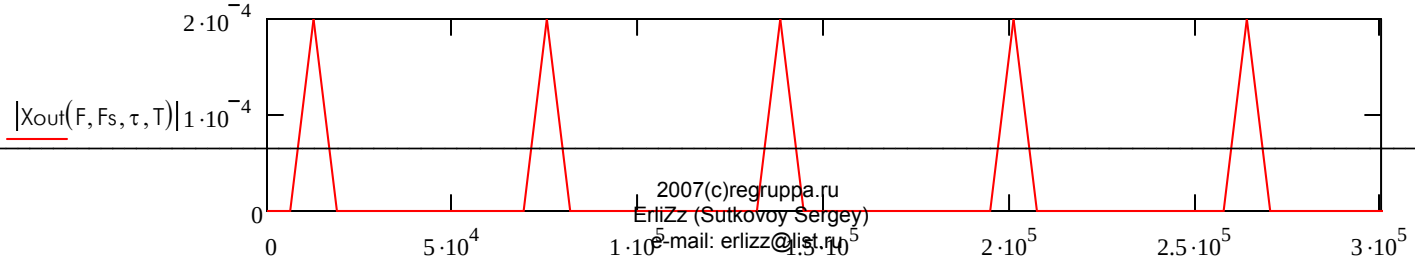
6 $\tau := 5\cdot10^{-6}\,\text{sec}$ $2\cdot\frac{\pi}{\tau} = 1.257\times10^{6}\,\frac{1}{s}$



7 $\tau := 1\cdot10^{-6}\,\text{sec}$ $2\cdot\frac{\pi}{\tau} = 6.283\times10^{6}\,\frac{1}{s}$

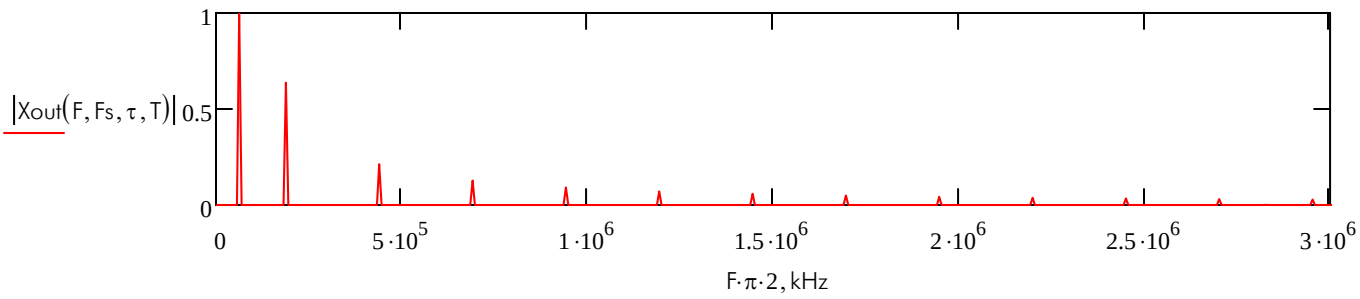


8 $\tau := 0.01\cdot10^{-6}\,\text{sec}$ $2\cdot\frac{\pi}{\tau} = 6.283\times10^{8}\,\frac{1}{s}$ $T := 100\cdot10^{-6}\,\text{sec}$



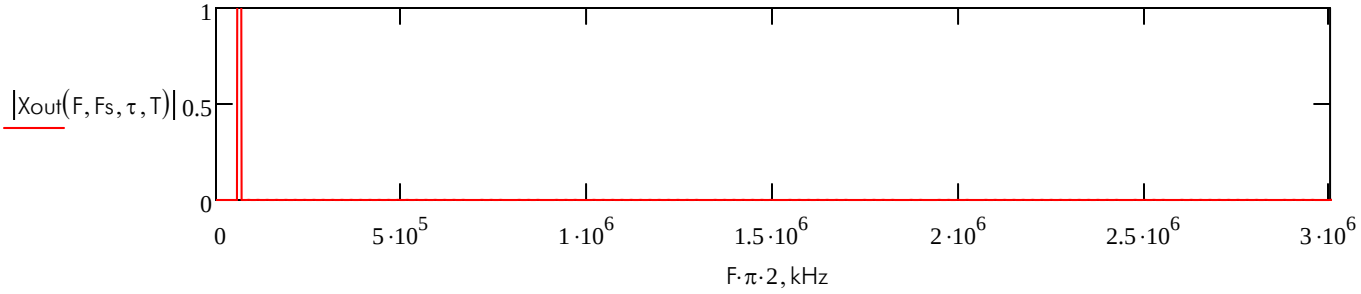
Зависимость Спектра ДГС от Частоты Самого Гармонического Сигнала

8 $\tau := 25\cdot10^{-6}\,sec$ $T := 50\cdot10^{-6}\,sec$ $2\cdot\frac{\pi}{\tau} = 2.513\times10^{5}\,\frac{1}{s}$ $Fs := 10kHz$



$\tau := 10^{-3}\,sec$ $T := 0.25\cdot10^{-3}\,sec$

$$Xout(F, Fs, \tau, T) := \left[\sum_{n=1}^{300}\left[\left(\frac{2}{n\cdot\pi}\right)\cdot\sin\left(\pi\cdot n\cdot\frac{\tau}{T}\right)\cdot Xsignal\left(F-\frac{n}{T}, Fs\right)\right]\right] + \left(2\cdot\frac{\tau}{T}\right)\cdot Xsignal(F, Fs)$$



$Ts := \frac{1}{Fs}$ $F := 0kHz, 1kHz .. 200kHz$

$$Xs(F) := \begin{cases} a \leftarrow \frac{|F|}{Fs} \\ \left(2\cdot\frac{\tau}{Ts}\right) \text{ if } a = 0 \\ \left[\left(2\cdot\frac{\tau}{Ts}\right)\cdot\frac{\sin\left(a\cdot\pi\cdot\frac{\tau}{Ts}\right)}{a\cdot\pi\cdot\frac{\tau}{Ts}}\right] \text{ otherwise} \end{cases}$$