Фильтр 1-го типа

$N := 13 \quad k := 0..N-1 \quad \Omega_k := \frac{k}{N}$

Аппроксимация

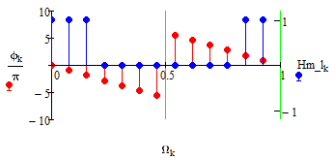
$\Phi := 0 \quad \beta := 0$

$$\phi_k := \begin{cases} \Phi \leftarrow \beta - \frac{N-1}{N}\cdot\pi\cdot k & \text{if } k \le \frac{N-1}{2} \\ \Phi \leftarrow -\beta - \frac{N-1}{N}\cdot\pi\cdot(k-N) & \text{otherwise} \end{cases}$$

Аппроксимация АЧХ:

ФНЧ

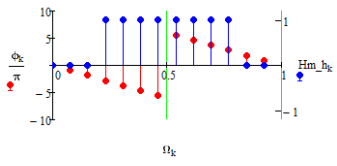
$Hm\_l := (1\ 1\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 1)^T$



$H\_l_k := Hm\_l_k \cdot e^{i\cdot\phi_k}$

ФВЧ

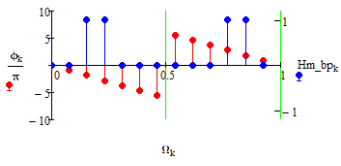
$Hm\_h := (0\ 0\ 0\ 1\ 1\ 1\ 1\ 1\ 1\ 1\ 1\ 0\ 0)^T$



$H\_h_k := Hm\_h_k \cdot e^{i\cdot\phi_k}$

Полосовой

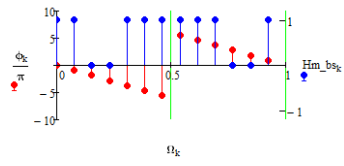
$Hm\_bp := (0\ 0\ 1\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 1\ 0)^T$



$H\_bp_k := Hm\_bp_k \cdot e^{i\cdot\phi_k}$

Режекторный

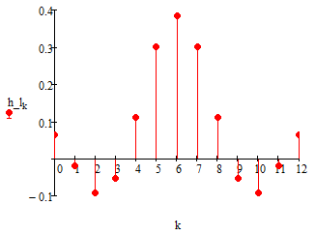
$Hm\_bs := (1\ 1\ 0\ 0\ 1\ 1\ 1\ 1\ 1\ 0\ 0\ 1)^T$



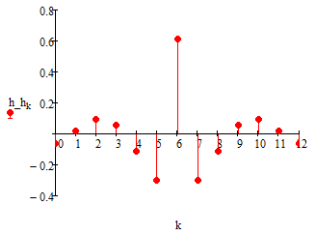
$H\_bs_k := Hm\_bs_k \cdot e^{i\cdot\phi_k}$

Выполняем обратное дискретное преобразование Фурье:

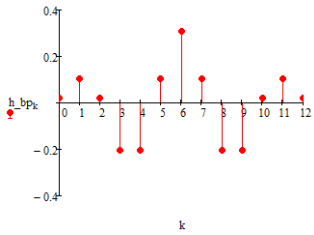
$$h\_l_k := \frac{1}{N}\cdot\sum_{n=0}^{N-1}\left(H\_l_n \cdot e^{i\cdot\frac{2\cdot\pi\cdot n\cdot k}{N}}\right)$$



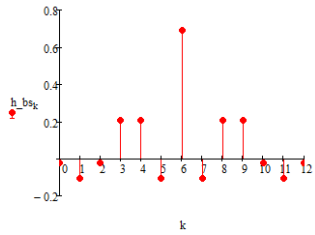
$$h\_h_k := \frac{1}{N}\cdot\sum_{n=0}^{N-1}\left(H\_h_n \cdot e^{i\cdot\frac{2\cdot\pi\cdot n\cdot k}{N}}\right)$$



$$h\_bp_k := \frac{1}{N}\cdot\sum_{n=0}^{N-1}\left(H\_bp_n \cdot e^{i\cdot\frac{2\cdot\pi\cdot n\cdot k}{N}}\right)$$



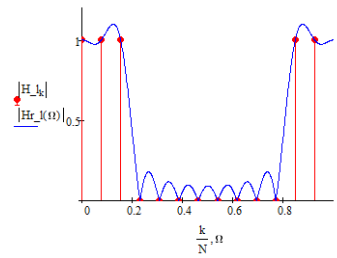
$$h\_bs_k := \frac{1}{N}\cdot\sum_{n=0}^{N-1}\left(H\_bs_n \cdot e^{i\cdot\frac{2\cdot\pi\cdot n\cdot k}{N}}\right)$$



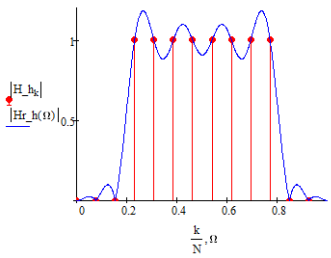
По импульсной характеристики восстанавливаем частотную:

$\Omega := 0, 0.001..1$

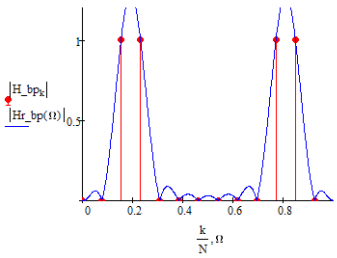
$$Hr\_l(\Omega) := \sum_{n=0}^{N-1}\left[h\_l_n \cdot e^{(-i\cdot 2\cdot\pi\cdot\Omega\cdot n)}\right]$$



$$Hr\_h(\Omega) := \sum_{n=0}^{N-1}\left[h\_h_n \cdot e^{(-i\cdot 2\cdot\pi\cdot\Omega\cdot n)}\right]$$



$$Hr\_bp(\Omega) := \sum_{n=0}^{N-1}\left[h\_bp_n \cdot e^{(-i\cdot 2\cdot\pi\cdot\Omega\cdot n)}\right]$$



$$Hr\_bs(\Omega) := \sum_{n=0}^{N-1}\left[h\_bs_n \cdot e^{(-i\cdot 2\cdot\pi\cdot\Omega\cdot n)}\right]$$