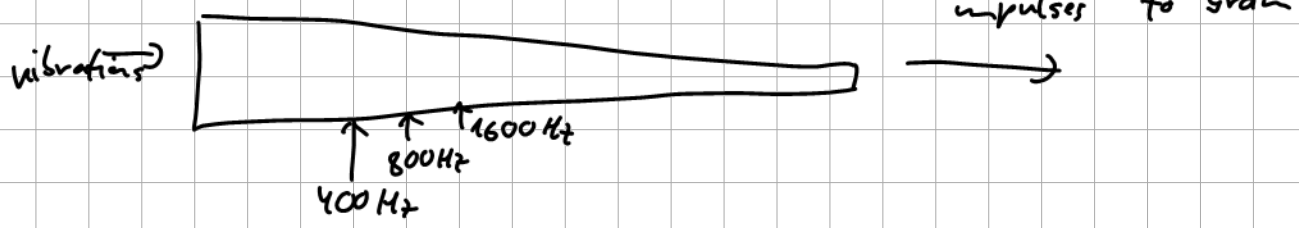
Cochlea



$f_1 = 440$ Hz Change note A

$f_2 = f_1 \cdot \underbrace{2^{1/12}}_{1.06} = 466$ Hz

$f_3 = f_2 \cdot 2^{1/12} = f_1 \cdot 2^{2/12} = 491$ Hz

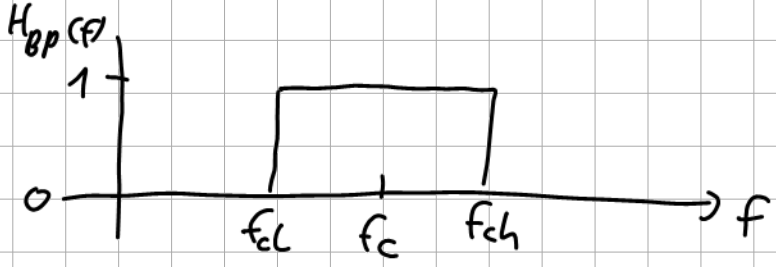
$\frac{f_y}{f_x} = 2.2$

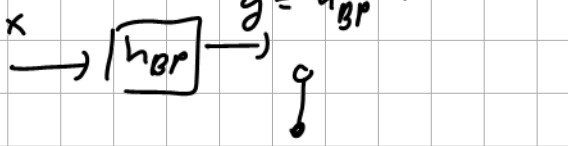
$f_x = 1000$ Hz
$f_y = 2200$ Hz

$2.2 = 2^{\frac{n}{12}}$ n is the number of HalfTones

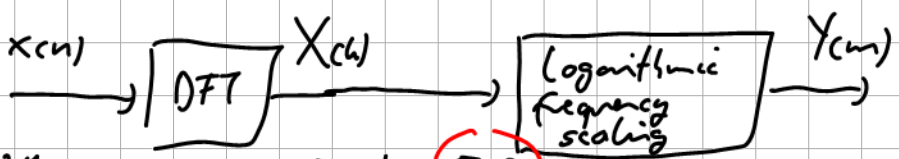
MeL FilterBank

- set of bandpasses





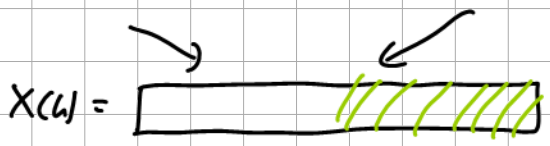
- special case MeL-FilterBank



$N = 1024$

$0 \leq k < 513$

$0 \leq m < 24$

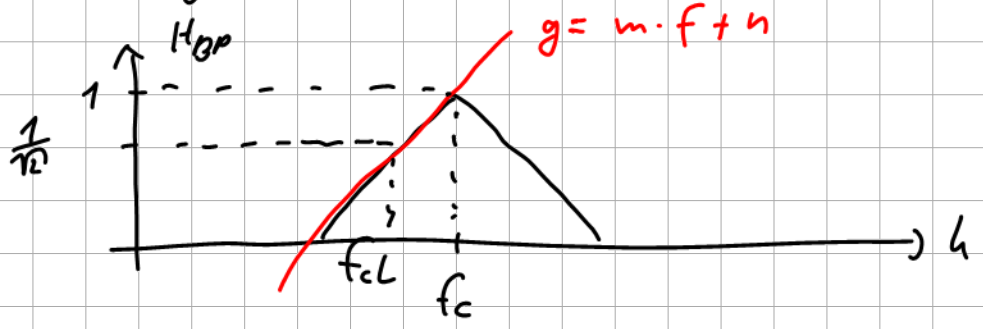


second half of symmetric spectrum is skipped

$X(k) = X^*(K-k)$

reduce the input vector in a meaningful way

reducing input size from 513 → 24 by bandpass



$$Y_{(m)} = \sum_k H_{BP(k)} \cdot X_{(k)}$$

e.g. $f_c = 2000\ Hz$ cut

$f_{cL} = 1800\ Hz$ cutoff low

$g = m \cdot f + n$

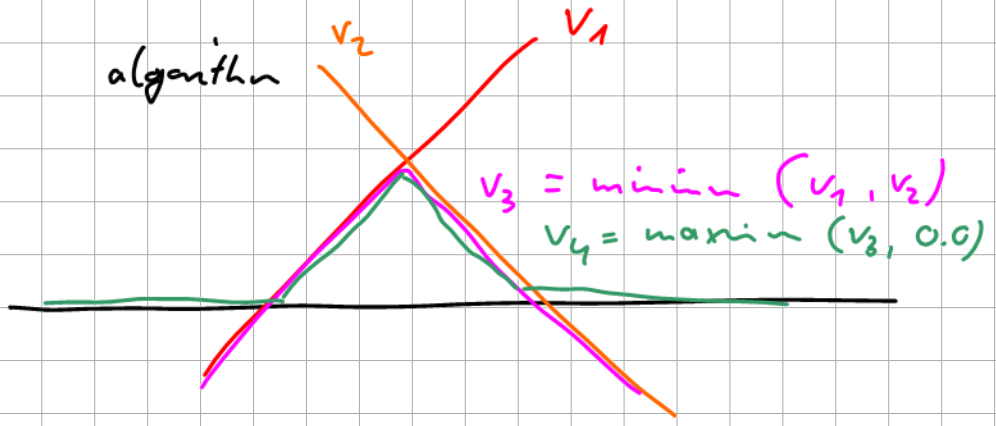
↳ slope $= \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - \frac{1}{\sqrt{2}}}{2000\ Hz - 1800\ Hz} = 0.00146\ \frac{1}{Hz}$

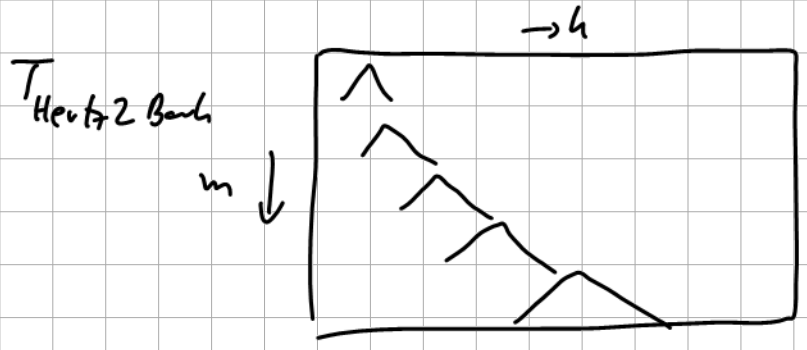
offset: $n = ?$

$1 = 0.00146\ \frac{1}{Hz} \cdot 2000\ Hz + n \quad \Rightarrow \quad n = -1.93$

or $\frac{1}{\sqrt{2}} = 0.00146\ \frac{1}{Hz} \cdot 1800\ Hz + n$

$n = 1 - m \cdot 2000\ Hz$

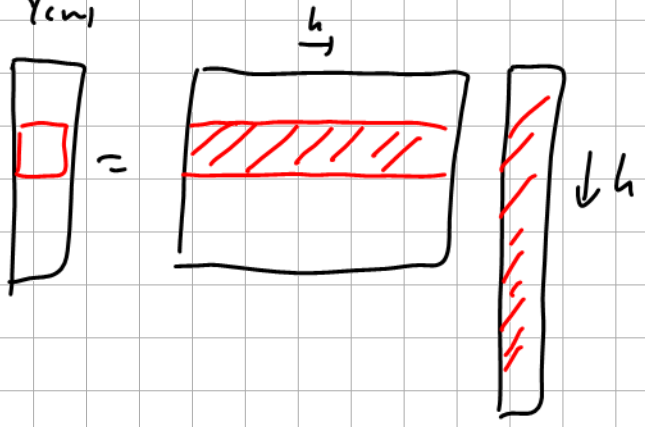




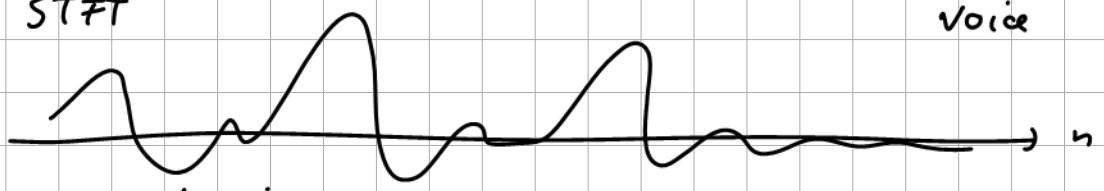
DFT

$x(n) \rightarrow X(k)$

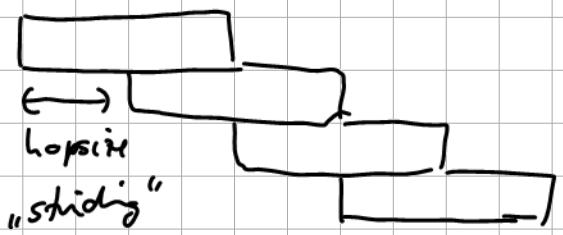
$Y(n) = T_{Hertz\,Bark} \cdot X(k)$

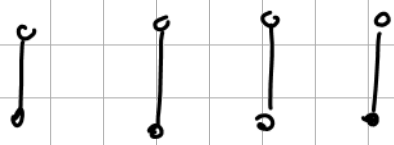


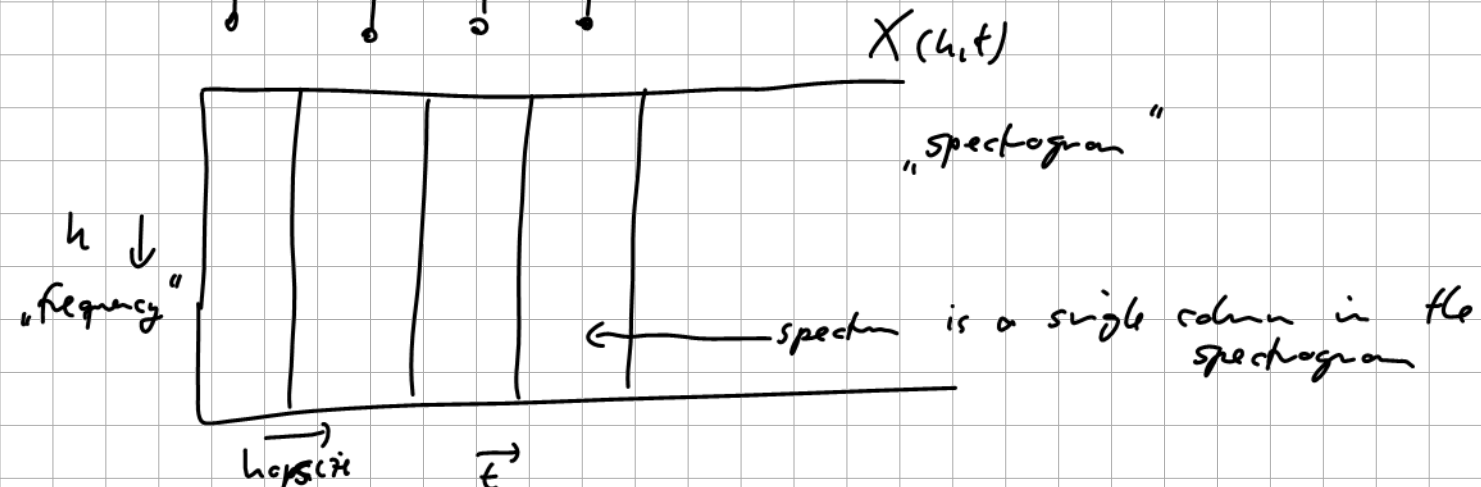
STFT



windowing

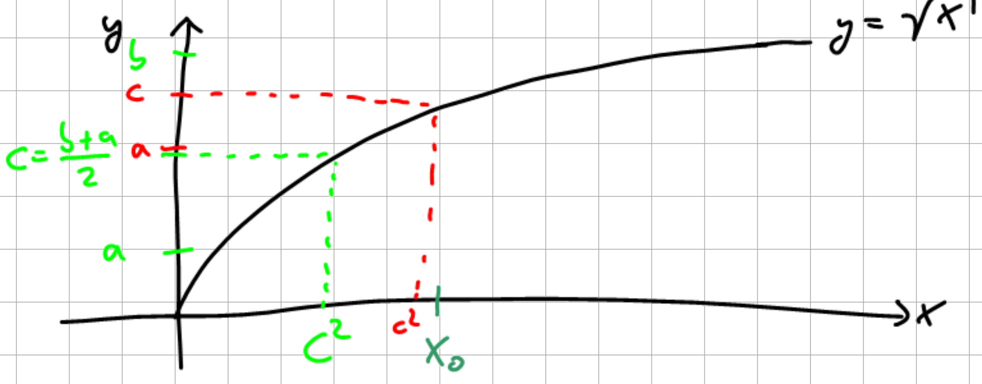






$$Y_{(m,t)} = T_{Hertz2Bark} \cdot X_{(h,t)}$$

Bisection Method



$\Rightarrow$ c^2 is too small

$\Rightarrow$ $a = c$