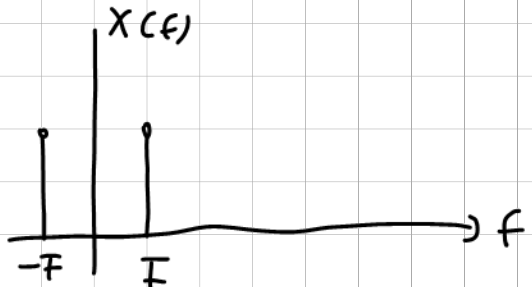
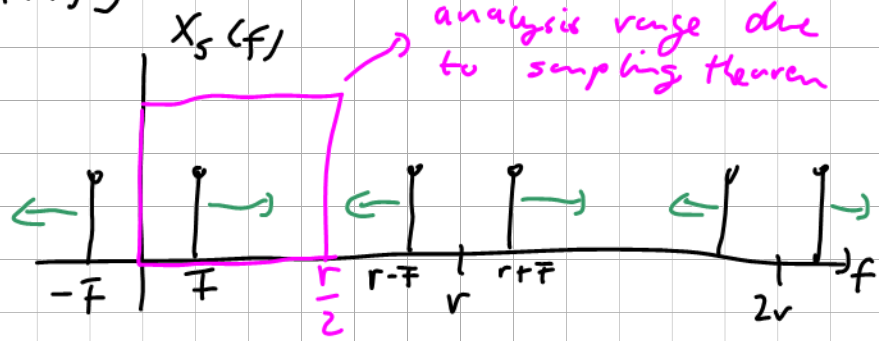
Violation of Sampling Theorem (more Cookies)

$$x(t) = \cos(2\pi F \cdot t) \xrightarrow[t = \frac{n}{r}]{\text{sampling}} x_s(n) = \cos\left(2\pi F \cdot \frac{n}{r}\right)$$

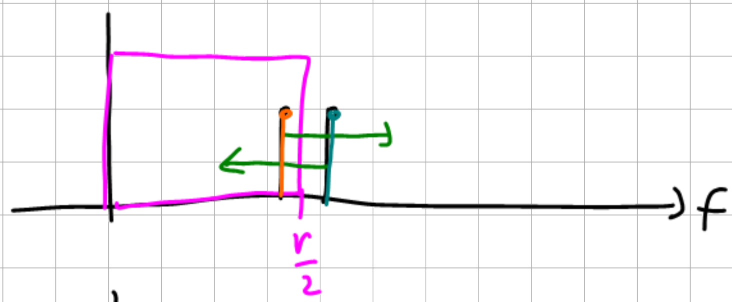
$r \hat{=}$ sampling rate

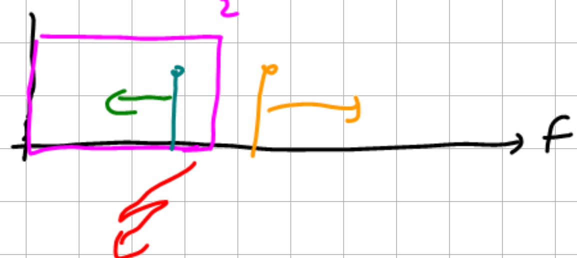
$$x(t) \circ\!\!-\!\!\bullet\; X(f) = \frac{1}{2}\left[\delta(f-F) + \delta(f+F)\right]$$





Sweep: Frequency is increasing



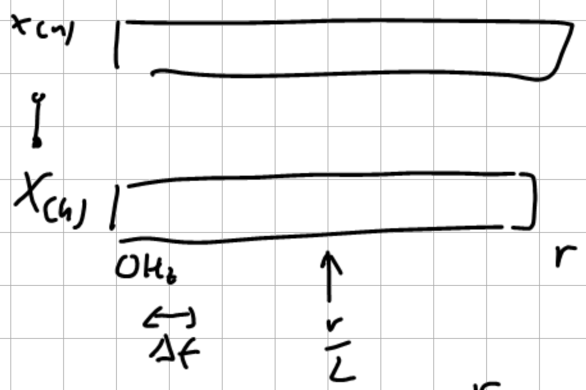


Violation of sampling theorem $\hat{=}$ Alias

DFT

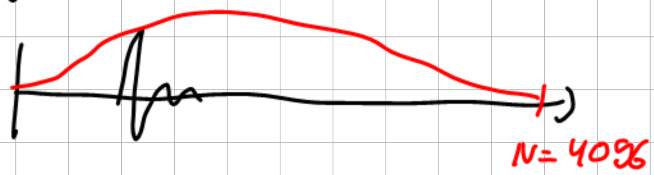
Block length: N

no zero padding: $N = K$

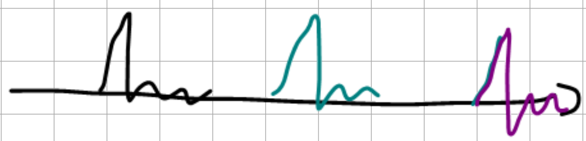


frequency resolution $\Delta f = \frac{r}{K}$

Long Blocks for STFT



for long Blocks it is unsure where (when) short events are happening



=> longer blocks are bad

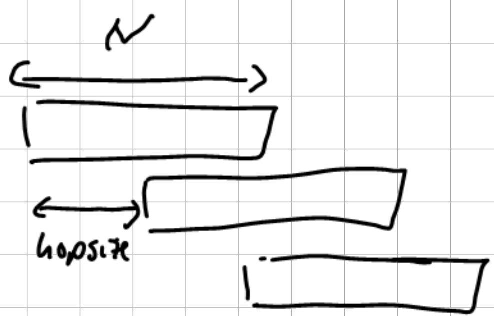
Frequency resolution ~~increases~~ becomes better (= decreasing Δf) with longer blocks:

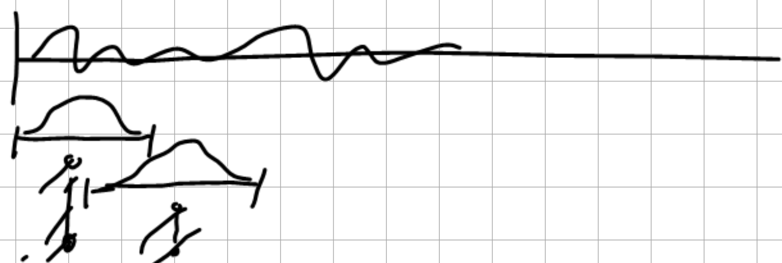
$$\Delta f = \frac{r}{K} = \frac{r}{N}$$ (no zero padding)

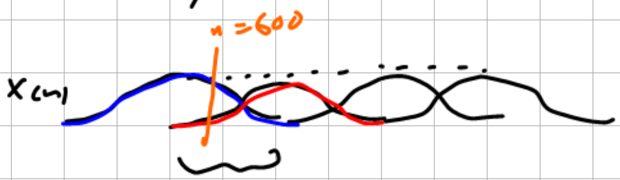
Programming Exercise

K = FFTLen

N = windowsize

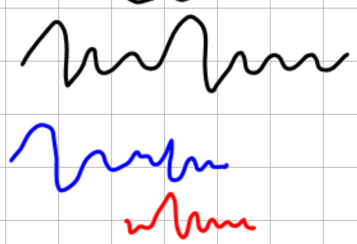






$N = 1000$

hopsize $= 500$

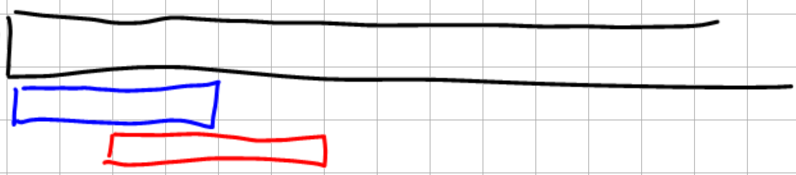


$w_1(n=600) = 0.8$
$w_2(n=600) = 0.2$

} constant overlap add for neighboring windows

$$x(n=600)\cdot w_1 + x(n=600)\cdot w_2 = x(n=600)$$

Analysis $x(n)$

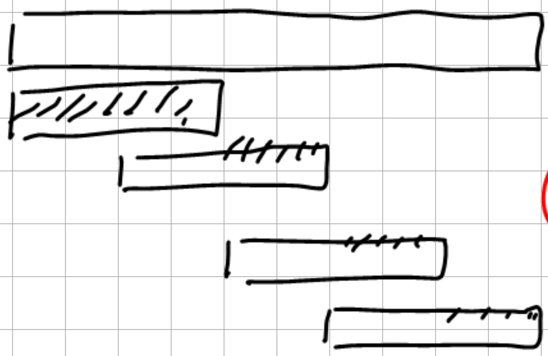


Synthesis

$y(n)$

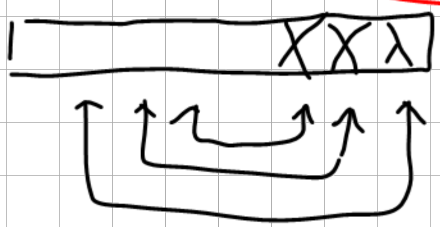
$L \leftarrow 10 \rightarrow$

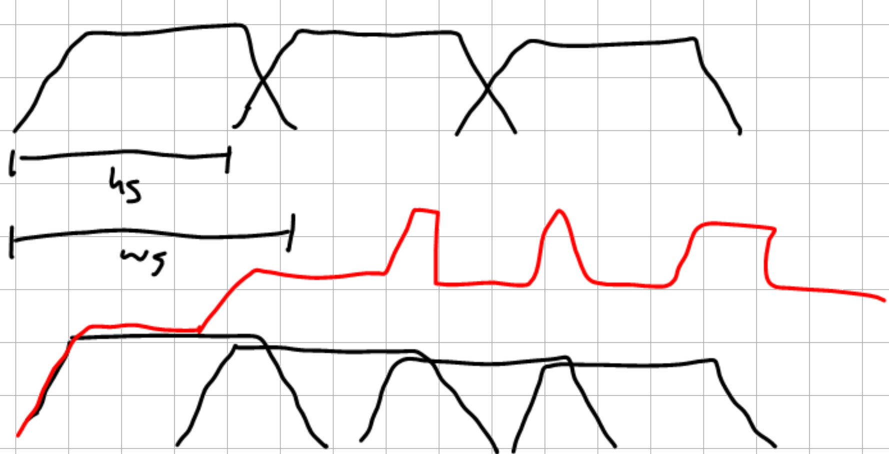
$N=4$
$hs = 2$

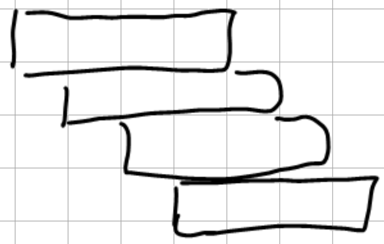


$$\text{int}\left(\frac{L-N}{hs}\right)+1 = X.\text{shape}[1]$$

$N=K=8 \Rightarrow$ $X.\text{shape}[0] = \frac{K}{2}+1$







$ws = 4 \cdot hs$

return y * factor(ws, hs)

$7 \to 4$
$8 \to 5$
$9 \to 5$