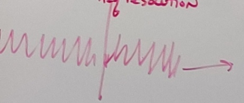
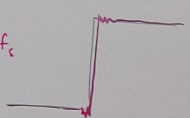
$\Delta t = 1/f_s = 1/256$ [s]

$T = 1/f_{req}$ resolution



$, \ldots, f_s$



$/_T = f$

MODIFIED DFT

$$\tilde{V}(f) = \sum_{n=0}^{N-1} w(t) * v(t) e^{2i f t} \Delta t$$

[nm/s] [sec]

[nm/s] [1/Hz]

$$\left(\sqrt{f_{res}} * \boxed{NENBW}\right) \to$$ UNIQUE PROPERTY OF THE WINDOW FUNCTION, $w(t)$

NORMALIZED EFFECTIVE NOISE BANDWIDTH

$\to$ ENBW

$$NENBW = \text{length}(w(t)) \left(\sum_{n=0}^{N-1} w^2(t)\right) \Big/ \left(\sum_{n=0}^{N-1} w(t)\right)^2$$

NFFT

HANN (ING)

[HAMM]

[BLACKMAN HARRIS]

PERIODOGRAM / POWER SPECTRAL DENSITY / AUTOCORRELATION / PSD

$$S_{vv}(f) \equiv \frac{1}{NT}\left(\sum_{n=0}^{N-1} v(t_n) e^{2\pi i f t} \Delta t\right)\left(\sum_{n=0}^{N-1} v(t_n) e^{2\pi i f t} \Delta t\right)^* = (Hz)\,[nm/s]^2 / [Hz]^2$$

$$= \frac{1}{NT} \tilde{V}(f) \tilde{V}^*(f)$$

$$= \frac{1}{NT} |\tilde{V}(f)|^2 \qquad = [nm/s]^2 / Hz$$

AMPLITUDE SPECTRAL DENSITY / ASD

$$A_{vv}(f) \equiv \sqrt{S_{vv}(f)} = [nm/s]/\sqrt{Hz}$$

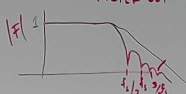
PWELCH METHOD

$$\sqrt{\left(\frac{1}{N_{AVGS}} \sum_{n_{AVGS}=1}^{N_{AVGS}} S_w(f)^2\right)}$$

NYQUIST FREQUENCY $\equiv f_s/2$

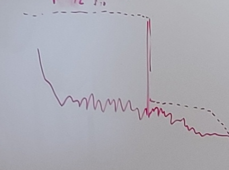
ANTI-ALIASING $\to$

TO FILTER OUT FOURIER "REFLECTIONS"



CUMULATIVE RMS OF AN ASD

$$A_w[RMS] = \sqrt{\frac{1}{f_s/2} \sum_{f=0}^{f_s/2} A_w^2(f)}$$



$$\tilde{Y}(f) = (TF)\,\tilde{X}(f)$$

$$TF_{xy} \equiv \frac{S_{xy}^2(f)}{(S_{xx}(f))(S_{yy}^2(f))}$$